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FOX (D. E.), CHAMBERLIN (J. C.) & DOUGLASS (J. R.). **Factors affecting Curly Top Damage to Sugar Beets in southern Idaho.**—*Tech. Bull. U.S. Dep. Agric.* no. 897, 29 pp., 7 figs., 17 refs. Washington, D.C., 1945.

The following is based upon the authors' summary. Investigations of the factors that determine the source, magnitude and time of dispersal of *Eutettix tenellus*, Baker, in relation to the incidence of the virus that causes curly-top disease [*Chlorogenus eutetticola* of Holmes], which it transmits, and the yield of sugar-beet were carried out in south-central Idaho in 1930–37. The populations of *E. tenellus* were estimated by hand collection in 1930–34, and subsequently by means of the square-foot sampling cage [*R.A.E.*, A **21** 611]. The amount of obvious curly-top was measured by observations on 300–500 beet plants in each field, and the percentage of total curly-top incidence by minutely examining 100 plants in each field.

Injury due to *E. tenellus* and the resultant curly-top was found to depend primarily on the date and magnitude of the spring movement of leafhoppers into the beet fields. The potential magnitude of such movement depends on the number of leafhoppers that enter hibernation in the preceding autumn, and its actual size on winter mortality and spring reproduction. The survival of autumn populations is favoured by early and widespread germination of the autumn and winter annual food-plants and moderate winter temperatures without excessive rainfall. Maximum reproduction in spring and early movement to the sugar-beet areas are favoured by an abundance of annual weed food-plants, sufficient rain to maintain them in good condition, and temperatures high enough to enable the spring generation to mature early. Under such conditions, even the spring generation that results from a low autumn population can produce widespread curly-top injury in the cultivated areas, provided that migration takes place early enough; such conditions occurred in south-central Idaho in 1934, following the lowest autumn population recorded during the investigation. On the other hand, the potentialities of comparatively high autumn populations may be so modified by subsequent conditions that a relatively small and late-maturing spring generation is produced and little damage from curly-top results. During the eight years under investigation, the date of the beginning of the spring migration varied from 27th April to 13th June, with a mean on 28th May. It is closely correlated with the date on which approximately 398 day-degrees above 50°F. have accumulated, as measured by thermograph records under standard shade conditions.

The principal annual summer food-plants on which autumn populations develop in the area under consideration are *Salsola kali* var. *tenuifolia* (the species previously referred to as *pestifer*) and sugar-beet. The total autumn populations on sugar-beet in 1934, 1935 and 1936 were 5·7, 5·5 and 1·0 per cent., respectively, of those on *Salsola*, but the smaller populations on beet are the more important, since a higher proportion of the individuals carry a more virulent strain of the virus [**27** 286]. This is transmitted to the autumn and spring wild food-plants and from them to sugar-beet in the following season.

The source of infestation is of great importance in relation to curly-top injury on sugar-beet, since the size of the spring generation and the date on which the leafhoppers become ready to migrate vary in different winter breeding areas. Infestation of sugar-beet is earliest and most severe and damage by curly-top heaviest to windward of large winter breeding areas in which the leafhoppers mature early. The earliest migrations in south-central Idaho are from the west and north-west of the cultivated areas, and westerly and north-westerly winds prevail during the period of the spring migration. Populations of *E. tenellus* and curly-top incidence were found in general to decrease progressively from west to east in the area studied, but this sequence was sometimes affected by leafhoppers from the more easterly and later breeding areas.

Although variations in agronomic factors cause fluctuations in mean yields, it was found that the major variations in 1930–37 were closely correlated with infestation by *E. tenellus* and the resultant curly-top damage, and the mean yield is not only the best available index of damage by *E. tenellus* and curly-top, but also a fairly accurate one.

Varieties of sugar-beet that are resistant to curly-top have been grown exclusively in south-central Idaho since 1935 and have given satisfactory yields even under conditions of severe infestation. They do better when migrant spring populations are small and late, however, and their use has therefore reduced the damage due to curly-top, but has not eliminated the problem of *E. tenellus*.

Entomology and Zoology.—*57th Rep. S. Carolina Exp. Sta. 1943–44* pp. 57–66, 4 figs. Clemson, S.C., 1945.

An account of work on the control of various insect pests in South Carolina in 1944 is given by O. L. Cartwright (pp. 57–61). Tests of fumigants against the rice weevil [*Calandra oryzae*, L.] and associated insects in stored maize were carried out in a large bin with double walls of tongue-and-grooved flooring boards separated by sisalkraft paper. The results showed that the dosage of chlorpicrin used for the fumigation of maize stored on the cob and with the sheaths intact should be at least 3 lb. per 1,000 cu. ft.; when lower rates were employed, some of the insects in the surface layers and the larvae within the grains were not killed. Methyl bromide at 3 lb. per 1,000 cu. ft. gave complete mortality of all stages of all the insects present, but when carbon bisulphide was used at 12 lb. per 1,000 cu. ft. all stages were killed only at the bottom of the bin. Untreated shelled maize and untreated maize cobs with or without the sheaths that were stored from 15th June 1943 until 26th October 1944 lost 39·37, 6·58 and 23·65 per cent. in weight, respectively, as a result of infestation by *C. oryzae* and other insects.

An attempt was made to rear *Macrocentrus delicatus*, Cress., on larvae of the potato tuber moth [*Gnorimoschema operculella*, Zell.] in the laboratory to provide stocks for release in peach orchards against the oriental fruit moth [*Cydia molesta*, Busck]. Rearing of *Gnorimoschema* was begun in April, and large numbers of peach twigs infested by *C. molesta* were collected in late May and June. The adult parasites emerged between 23rd June and 7th July, but only 43 females and 34 males were obtained. The females parasitised the larvae of *G. operculella*, and gave rise to a generation consisting of 71 females and 212 males, but, with the exception of a male that emerged on 12th August, no second generation was produced. Possible causes for the failure of this generation were the age of the available larvae of *G. operculella*, which were at least a week old when the parasites were ovipositing, and attack by Gamasid mites, which appeared in early July and seriously interfered with the rearing of the host larvae.

Dusts were applied three times against the tomato fruit worm [*Heliothis armigera*, Hb.] in experimental plots of tomato at two places. In one of them, the total yields per acre, and the weights of sound and of infested fruits were 7,342, 7,016 and 130 lb. for undiluted basic copper arsenate, 8,821, 8,416 and 212 lb. for basic copper arsenate and kaolin (1 : 1), 6,637, 6,158 and 235 lb. for 3 per cent. DDT, 3,482, 3,023 and 125 lb for a proprietary Paris green and kaolin (1 : 1), 5,701, 5,082 and 222 lb. for the Paris green diluted 1 : 9, and 8,383, 7,570 and 436 lb. for no treatment. Paris green caused severe scorching of both plants and fruits. The comparable figures at the second place were 5,376, 4,047 and 66 lb. for 3 per cent. DDT, 5,875, 3,414 and 609 lb. for 50 per cent. basic lead arsenate, 5,699, 3,318 and 658 lb. for 50 per cent. cryolite, 4,937, 3,093 and 283 lb. for 70 per cent. cryolite, 4,887, 2,828 and 680 lb. for 33 per cent. calcium arsenate in kaolin, 2,308, 1,090 and 254 lb. for 33 per cent.

basic copper arsenate, and 4,623, 1,692 and 1,345 lb. for no treatment. In this test, basic copper arsenate was the only dust that did not give a significant reduction in damage; the quality of the fruit from plants treated with it was unusually good. The dust containing 3 per cent. DDT was used in preliminary tests against other insects. It gave complete control of cabbage caterpillars, and protected potato plants from the Colorado potato beetle [*Leptinotarsa decemlineata*, Say]. Only 11·1 per cent. of the fruits harvested from squash plants dusted with it at 30-day intervals were infested by the pickle-worm [*Diaphania nitidalis*, Stoll], as compared with 27·5 per cent. from untreated plants. Infestation of cucumbers by the same insect was 6·3 per cent. on treated and 42·6 per cent. on untreated plants. Of 358 cantaloupe melons harvested from plots dusted four times, and 359 from untreated plots, one and 12 were damaged by *D. nitidalis* and none and 105 by *Feltia subterranea*, F. The corn earworm [*Heliothis armigera*] injured 32·2 per cent. of the ears of sweet maize, of which the silks had been dusted, as compared with 86·2 per cent. of untreated ears. In cage tests, harlequin cabbage bugs [*Murgantia histrionica*, Hahn] placed on potted kale plants that had previously been dusted died within 36–48 hours, whereas others placed on undusted plants were still active. Seed maize artificially infested with *Calandra oryzae* and treated with the dust at the rate of 2 oz. per bushel on 14th April, contained no living insects on 14th November, and its germinating properties were unaffected [*cf. R.A.E.*, A **34** 333]; untreated maize stored at the same time was seriously damaged by *C. oryzae* and other insects.

D. Dunavan (pp. 61–62) describes experiments in which dusts of undiluted sodium fluosilicate, undiluted basic copper arsenate and 3 per cent. DDT were applied against the cowpea curculio [*Chalcodermus aeneus*, Boh.] to cowpeas that had been sown on dates that favour infestation (30th May and 19th June). Applications were made at intervals of 4–5 days from the beginning of fruiting until the end of harvest. None of the dusts gave adequate control, and the sodium fluosilicate reduced the crop very considerably; it appears to hinder pod formation and to cause serious stunting of the pods. The yields from plots dusted with DDT were the highest and the pods were long and well-formed, but the plants ceased to fruit about a week before those on other plots.

BONDY (F. F.) & RAINWATER (C. F.). **Cotton Insect Investigations.**—*57th Rep. S. Carolina Exp. Sta. 1943–44* pp. 99–104, 1 fig. Clemson, S.C., 1945.

Although calcium arsenate dust is the most effective insecticide for the control of the cotton boll weevil [*Anthonomus grandis*, Boh.], its use has not become general in South Carolina owing to the risk of injury to light sandy soil, and investigations were therefore begun in 1944 to discover other effective insecticides or correctives for use with it. In laboratory tests with potted plants, iron [ferric] arsenate (scorodite) mixed with sandy soil at rates equivalent to 50, 100, 200 and 400 lb. per acre stimulated the growth of cowpeas and did not affect that of cotton, whereas calcium arsenate injured cowpeas at 50 lb. per acre and cotton at 200 lb. The oxides of various metals were tested as correctives for calcium arsenate in sandy soil by sowing cotton and cowpeas in the treated soil on 21st April and again, without further treatment, on 1st July. None of the oxides prevented injury, but some, notably those of lead, iron and, in the second planting, zinc, reduced it. Basic copper arsenate was also applied to the soil in these tests and caused no apparent injury. In another experiment, various arsenicals were hoed into the soil at rates of 125, 250 and 500 lb. per acre, and cotton and cowpeas were sown in the plots on 1st July. The materials tested, in order of decreasing injuriousness, were Paris green, calcium arsenate, a mixture of lead and calcium arsenates combined during manufacture, lead arsenate, basic copper arsenate and magnesium arsenate. Mixtures of equal parts of calcium arsenate and Paris green, magnesium arsenate or basic copper

arsenate also reduced the growth of such plants as survived. The arsenates of iron and magnesium are known to be of little value against *A. grandis*, and lead arsenate is less effective than calcium arsenate, but basic copper arsenate has given good control in experiments in South Carolina and in other States [*cf. R.A.E.*, A **33** 335, etc.].

In small-scale experiments to discover dusts for the combined control of *A. grandis* and the cotton Aphid [*Aphis gossypii*, Glov.], basic copper arsenate was as effective as calcium arsenate against the weevil, and lead arsenate, magnesium arsenate, potassium fluosilicate, barium fluosilicate and synthetic cryolite less so. When added to calcium arsenate, 0·75 per cent. rotenone, 1 per cent. nicotine derived from Black Leaf 40 [nicotine sulphate] and 0·5 per cent. nicotine from Black Leaf 40 with 0·5 per cent. rotenone gave satisfactory control of the Aphid and were more effective against it than 1 per cent. nicotine from Black Leaf 10 [finely ground tobacco stems impregnated with 10 per cent. by weight free nicotine], or Black Leaf 155 [14 per cent. nicotine fixed on bentonite]. When 14 per cent. Lethane B–71 [14 per cent. aliphatic thiocyanate] was added to the calcium arsenate dust, Aphid populations were greater than when calcium arsenate was used alone. In large scale field experiments in 1944, the average percentage infestation by the weevil, number of Aphids per leaf and yield in lb. seed cotton per acre were, respectively, 35·21, 5·59 and 1,132 where no treatment was applied, 26·66, 6·87 and 1,213 where the usual mopping mixture [**31** 188] was applied three times in the presquare stage, and 18·12, 9·36 and 1·396 where this treatment was followed by one application of a dust of calcium arsenate with 1 per cent. nicotine when infestation by *Anthonomus* reached 10 per cent.

ALLEN (N.). **Control of Tobacco Hornworm and Tobacco Flea Beetle with basic Copper Arsenate.**—*57th Rep. S. Carolina Exp. Sta. 1943–44* pp. 114–117, 1 fig. Clemson, S.C., 1945.

It is necessary in South Carolina to control both the tobacco hornworm [*Protoparce sexta*, Joh.] and the tobacco flea-beetle [*Epitrix hirtipennis*, Melsh. (*parvula*, auct.)] if a good crop of tobacco is to be obtained. Work on the subject has been in progress since 1936, and the earlier investigations on the flea-beetle have already been noticed [*R.A.E.*, A **30** 44]. From 1941, when an adjustable spray boom that gave adequate coverage to control both insects was developed [**31** 255], attention was focussed on materials for combined control, and promising results were obtained with a spray of 6 lb. basic copper arsenate and 1 lb. wheat flour in 50 U.S. gals. water applied at a rate of at least 70–80 U.S. gals per acre. The initial toxicity of basic copper arsenate to *Epitrix* is less and the residual toxicity much greater than that of rotenone [*cf. loc. cit.*]. Sprays containing lead arsenate or cryolite at concentrations effective against *Protoparce* required the addition of rotenone if *Epitrix* was to be controlled, whereas cryolite dusts controlled the latter but not the former unless the rate of application was heavy. Lead arsenate was the most effective insecticide tested against *Protoparce*, and a spray containing 4 lb. with 1 lb. wheat flour in 50 U.S. gals. applied at a rate of 75 U.S. gals. per acre gave good control. A dust mixture containing 10 per cent. DDT did not control *Protoparce* when applied either as a dust or as a spray. Barium fluosilicate was fairly effective against *Protoparce*, but sprays containing it caused slight injury to the plants, and sodium fluosilicate, which was very toxic to the larvae, may cause more injury.

WATSON (J. R.). **The Damage of *Melipotis acontioides* to the Royal Poinciana.** —*Florida Ent.* **27** nos. 3–4 pp. 58–59, 103; **28** no. 1 pp. 18–19, 1 fig. Gainesville, Fla., 1944–45.

Lyncestis (*Melipotis*) *acontioides*, Gn., has recently caused severe damage to Royal Poinciana [*Poinciana regia*] at Key West and places on the west coast of

Florida [*cf. R.A.E.*, A **32** 426]. The trees are normally leafless from November–December until March–April, but some that were defoliated by the larvae of this Noctuid in July 1943 did not develop new foliage until June 1944. Others produced new leaves in autumn, however, and larvae were noted on these in January, when they are not normally present. Small larvae were observed on trees at Key West on 3rd April 1944, but later disappeared and no more were noted until 16th October ; several generations probably occurred during that period, but escaped notice owing to their small numbers. Larvae migrating down the trunk in the morning and up it at night were found to congregate beneath the upper and lower edges of cardboard bands smeared with an adhesive that were fixed round the trunks of the trees ; they also sheltered during the day in a box at the foot of the trunk and, in January, in pods that were splitting open on the trees. Large numbers of larvae on a heavily-infested tree were stated to have been destroyed in August by a dust containing 5 per cent. DDT.

DICKE (F. F.) & JENKINS (M. T.). **Susceptibility of certain Strains of Field Corn in Hybrid Combinations to Damage by Corn Earworms.**—*Tech. Bull. U.S. Dep. Agric.* no. 898, 36 pp., 1 pl., 1 ref. Washington, D.C., 1945.

The following is largely based on the authors' summary. Investigations were carried out near Washington, D.C., in 1935–42 to identify inbred strains of field maize capable of contributing factors for protection against damage to the ears by Lepidopterous larvae. *Heliothis armigera*, Hb., was the main pest during the period under review ; *Laphygma frugiperda*, S. & A., which generally appears at the end of July and is occasionally abundant in late maize, was of minor importance in most years. In a discussion of the factors that affect the rate of oviposition by *H. armigera* and the amount of injury by the larvae, it is stated that the number of eggs laid per ear varies inversely with the number of ears with silks in the attractive stage that are available for oviposition [*cf. R.A.E.*, A **28** 346]. There is an increase in the rate after the first week of August, when ears with attractive silks become less common and the adult moths become more so, and silks that are resistant to drying are likely to receive more eggs than others during midsummer. The amount of injury is reduced not only by a tight-fitting husk [*cf.* **24** 304], but also by hard kernel texture. Infestation by *L. frugiperda* is reduced by the same ear characters, and in addition by a quickly-drying husk, through which the larvae cannot easily burrow.

By means of top crosses (in which a group of inbred lines were crossed with one variety in order to determine their general contribution to their hybrid progeny) and single crosses, it was possible to identify a group of inbred strains that were consistent in transmitting to hybrids ear-qualities that gave good protection against damage by larvae. Ten strains with yellow seeds and ten with white that possessed this ability to a marked degree are enumerated. In general, the ears of hybrids of these strains are protected by sheaths that fit closely round and over the tip and extend at least one inch beyond it, and the amount of hard starch exceeds the average in all the grains or in those at the tip of the ear. The relative amount of damage among several long-sheathed strains of Corn Belt lines was as variable as it was among strains with short sheaths, showing that a long sheath does not in itself afford maximum protection. As a rule, however, the strains with long sheaths sustained less damage. The factors for protection against damage expressed by inbred lines in the single crosses were also present in the hybrids obtained when they were used in double crosses, and the variability of damage among strains with long sheaths was still apparent. At the prevailing levels of infestation, several strains that are widely used in commercial hybrids produced susceptible hybrids when used in single, double and top crosses. The available data indicate that these and

other important inbred lines at present in commercial use may be greatly improved in resistance through the use of proper breeding techniques. For effective protection against damage in double crosses at high population levels it is desirable to have three resistant inbred lines represented in the cross.

RIEDL (W. A.) & HARRISON (L. R.). **The Control of Psyllids and Flea Beetles on Potatoes.**—*Bull. Wyo. agric. Exp. Sta.* no. 271, 27 pp., 8 figs., 15 refs. Laramie, Wyo., 1945.

Two of the most important insect pests of potato in Wyoming are *Epitrix tuberis*, Gentner [*cf. R.A.E.*, A **33** 220], which injures potatoes grown under irrigation in the North Platte Valley, and *Paratrioza cockerelli*, Šulc [*cf.* **32** 254]. The adults of *E. tuberis* feed on the leaves, but are less injurious than the larvae, which tunnel along the surface of the developing tubers or into them to a depth of ¼ inch or more [*cf.* **33** 220]. *P. cockerelli* causes the condition known as psyllid yellows.

In tests in 1943 in a field infested by *E. tuberis*, but not by the Psyllid, dusts of 325-mesh sulphur with 7 per cent. conditioning agent, alone or with Dutox (mainly barium fluosilicate [*cf.* **31** 396]), calcium arsenate or zinc arsenite (4 : 1), or with cryolite (1 : 1, 2 : 1, 4 : 1 or 6 : 1), and a spray of lime-sulphur (1 : 40) containing 4 lb. zinc arsenite per 100 U.S. gals. were applied on 16th July, when the plants were about a foot high, and on 6th August, when they almost covered the row. All treatments caused a significant reduction in the adult population and in tuber injury, but no significant increase in yield. Sulphur with cryolite (6 : 1) was the most effective against the adults. There was no significant difference in tuber injury between treatments, though the spray was the least effective and sulphur with cryolite (2 : 1) the most effective, followed by sulphur with Dutox or cryolite (4 : 1). The last two gave the best average control of adults and larvae. In a field in which the Psyllid population was low and *E. tuberis* did not occur, a 90 per cent. microfine sulphur dust and two 325-mesh sulphur dusts containing 7 per cent. of different conditioning agents, applied on 14th and 26th July and 11th August, gave approximately equal yields. Applications of 10, 20 and 30 lb. per acre usually gave significant increases in yield over no treatment, and there were no significant differences between them.

The sulphur dust used in all the experiments in 1944 was 325-mesh with 7 per cent. conditioning agent. Potatoes infested heavily by the flea-beetle and lightly by the Psyllid were treated on 12th July, when they were about eight inches high, and on 21st and 29th July and 4th and 22nd August. Dusts of sulphur alone or with Dutox (4 : 1), basic copper arsenate (4 : 1), cryolite (3 : 1 or 4 : 1) or Kryocide (natural cryolite) (3 : 1) gave significant increases in yield, but a dust of sulphur and calcium arsenate (4 : 1) and a spray of lime-sulphur (1 : 40) containing 5 lb. zinc arsenite per 100 U.S. gals. did not. Sulphur alone or with Kryocide or cryolite (3 : 1) gave the best control of nymphs and adults of *P. cockerelli*, and sulphur with Kryocide or with cryolite (3 : 1 or 4 : 1) gave significantly higher yields of tubers free from flea-beetle injury and better control of the adult flea-beetles than the other materials. Where the Psyllid population was high, but *E. tuberis* was absent, and applications of 10, 20 and 30 lb. sulphur dust per acre were made on 9th and 27th July and 14th and 24th August, the yields increased with the rate of application and all differences were significant. Where the dust was applied at 20 lb. per acre and the Psyllid population was high, the yield was significantly improved by covering the boom with a canvas hood when applications were made from each side of the row but not when they were made from above, and treatment from each side with a hood was slightly, though not significantly, better than treatment from above with or without a hood. No significant differences in yield resulted from

any of the four methods of application when the Psyllid population was low, the flea-beetle population high and a dust of sulphur and cryolite (4 : 1) was applied at 30 lb. per acre.

In preliminary tests with new materials, none prevented injury to the tubers by larvae of the flea-beetle, but 3 per cent. DDT in sulphur and 0·5 per cent. rotenone in sulphur gave excellent control of the adults. The second dust and a spray of lime-sulphur (1 : 40) containing 5 lb. zinc arsenite and 3 lb. Dithane [disodium ethylene bisdithiocarbamate] per 100 U.S. gals. gave the best control of nymphs and adults of the Psyllid, and the rotenone dust was the only treatment that gave a significantly higher total yield than no treatment ; there were no significant differences in yield between the various treatments.

As a result of these experiments, a sulphur dust of at least 325-mesh fineness containing not more than 10 per cent. conditioning agent is recommended when only *P. cockerelli* is present. It should be applied in the early morning or at night when there is little or no wind. Treatment is required when the number of adults per 100 sweeps of the net averages 2–3, and the first application is usually necessary when the plants are 4–6 ins. high. At least two applications should be made to potatoes grown under dry-land conditions and 3–4 to those grown under irrigation, at intervals of 2–3 weeks or less ; frequent light applications give better control than less frequent heavy ones. The rate of application should be about 20 lb. per acre when the plants are small, and it should be increased to 30 lb. as they grow. The dust should be applied from each side of the row with a hood over the boom or from above the row if a hood is not used. If a spray is to be employed, lime-sulphur (1 : 40) should be applied with at least three nozzles per row and a pressure of 300–500 lb. per sq. in. When both insects are present, dusts of sulphur with cryolite (2 : 1, 3 : 1 or 4 : 1) or Dutox (4 : 1) should be applied at the rate of 30–40 lb. per acre 5–6 times at intervals of 7–10 days from the time when the plants are 4–6 inches high. For a spray, lime-sulphur (1 : 40) with the addition of 5 lb. zinc arsenite per 100 U.S. gals. should be used.

ACREE jr. (F.), JACOBSON (M.) & HALLER (H. L.). **An Amide possessing insecticidal Properties from the Roots of *Erigeron affinis* DC.**—*J. organic Chem.* **10** no. 3 pp. 236–242, 1 graph, 5 refs. Baltimore, Md., 1945.

Erigeron affinis is a composite that grows near Mexico City, where the roots are used in the preparation of native insecticides. The petroleum-ether extractive from the powdered roots has been found to be toxic to various insects, including larvae of the codling moth [*Cydia pomonella*, L.] and to have the same order of paralysing action and toxicity to house-flies as the pyrethrins. The toxic fraction was isolated from the extractive by a method already described [*R.A.E.*, A **33** 189] and proved to be an unsaturated isobutylamide, for which the name affinin is proposed. Its formula is discussed.

HALLER (H. L.) & others. **The chemical Composition of technical DDT.**—*J. Amer. chem. Soc.* **67** pp. 1591–1602, 21 refs. Easton, Pa., 1945.

CRISTOL (S. J.), HAYES (R. A.) & HALLER (H. L.). **Determination of 1-trichloro-2, 2-bis (*p*-chlorophenyl) ethane in technical DDT.**—*Industr. Engng Chem.* Anal. Edn. **17** no. 8 pp. 470–472, 1 graph, 7 refs. Easton, Pa., 1945.

In the first of these papers, the authors point out the importance of studying the composition of technical (commercial-grade) DDT in order to determine the nature and amount of the by-product materials and to compare them insecticidally and pharmacologically with 1-trichlor-2, 2-bis (parachlorphenyl) ethane, referred to as p,p'-DDT. The technical product was found to be a

complex mixture containing more than 70 per cent. p,p′-DDT with 1-trichlor-2-o-chlorphenyl-2-p-chlorphenylethane (o,p′-DDT) as the major impurity. In all, 14 compounds were isolated from various samples of technical DDT; all of these and the uncrystallisable oils were tested as insecticides, but although some were effective, none was so toxic as p,p′-DDT.

In the second paper, a method is described for the determination of p,p′-DDT in technical grades of DDT, with modifications for use in the case of dusts and by-product oils.

BARTHEL (W. F.) & HALLER (H. L.). **Apparatus for rapid Removal of Solvents.**—*Industr. Engng Chem.* Anal. Edn. **17** p. 529, 1 fig., 2 refs. Easton, Pa., 1945.

When purified pyrethrum concentrates are prepared with nitromethane as a solvent, it is difficult to prevent the decomposition of the pyrethrum concentrate while distilling the nitromethane [*cf.* *R.A.E.*, A **33** 189–190]. The authors therefore constructed an apparatus, which is described and figured in this paper, with which the solvent is removed under reduced pressure. It also proved effective for removing medium-boiling solvents from other plant extracts and organic compounds and for the rapid concentration of solutions. For liquids boiling below 70–80°C. it can be used without vacuum.

HOPPING (G. R.) & MATHERS (W. G.). **Observations on Outbreaks and Control of the Mountain Pine Beetle in the Lodge-pole Pine Stands of western Canada.**—*For. Chron.* **11** no. 2 pp. 98–108, 2 figs., 7 refs. Toronto, 1945.

A short account is given of the outbreaks of *Dendroctonus monticolae*, Hopk., that have occurred in *Pinus contorta* var. *latifolia* in western Canada since 1920; all available records indicate that they have been more frequent and extensive during this period than in the two previous decades. The most recent one began in 1940 at Banff, Alberta, and is 12 miles at the nearest point from the infestation at Kootenay National Park, British Columbia [*cf.* *R.A.E.*, A **32** 22], and separated from it by a range of mountains containing only one pass less than 6,000 ft. high; it is therefore considered to have developed independently. Possible causes of these two outbreaks are discussed, and it is concluded that they developed during a period of deficient moisture and that drought may be the main underlying cause.

Control measures at Banff were begun in 1941. They were started as early in autumn and continued as late in spring as possible. The forest was surveyed for infested trees and these were cut to ground level and burnt, except for 500 trees in the immediate vicinity of Banff, which were salvaged by barking the trunks, burning the bark and unusable portions and grubbing out the stumps. Any trees that were scorched by the fires were cut and burnt. Trees that had been infested in the previous year and had turned red were removed as well as green (newly infested) ones, as trees are often attacked on only one side in one summer and on the other in the following year, and also in order to reduce the risk of fire and to make possible an accurate check on green trees that were missed. All the infested areas, totalling over 10,000 acres, had been treated once, and some twice, by the spring of 1943. It was found that only 2 per cent. of the green infested trees had been missed, and that there was an infiltration of beetles into the treated areas from contiguous untreated ones. A survey in September 1943 showed only one area with appreciable reinfestation; this amounted to less than one tree per three acres and was probably due to an unusual number of windfalls, which apparently attracted beetles that survived in the tree bases.

It is concluded that control work should be begun when the first sign of abnormal increase in bark-beetles becomes apparent and that it is unlikely to be successful over a considerable area if there is an average of as many as five green infested trees per acre ; in this case salvage by means of portable mills would be more profitable. The control area should be geographically isolated from any other source of infestation, and control measures continued for as long as the underlying causes of the infestation are operative. The entire area should be covered and every infested tree treated by the end of the second year, and all areas treated the first year should be examined a second time. It is advisable to remove all trees showing any sign of attack. Complete burns are preferable ; all trees scorched by fire should be felled and burnt, and fresh windfalls and broken tops should be destroyed. As long as the character of the stand remains unchanged, outbreaks may be expected whenever tree vigour is seriously reduced, and the only permanent remedy is to alter the composition of the stand, gradually eliminating a large proportion of the lodgepole pine and establishing a mixed stand.

SUIRE (J.). **Les premiers états de** *Batrachedra ledereriella* **Z. (Lep. Cosmopteryginae) (note préliminaire).**—*Bull. Soc. ent. Fr.* **45** no. 6 pp. 65–69, 5 figs. Paris, 1940.

In 1938 and 1939, larvae of *Batrachedra ledereriella*, Zell., were found feeding within the ovisacs of *Icerya purchasi*, Mask., in two districts in south-eastern France. This Tineid, the egg, larva and pupa of which are described, has been recorded from many plants, from the nests of larvae of *Nygmia phaeorrhoea*, Don. (*Porthesia chrysorrhea*, auct.), from the galleries of Bostrychids, and as feeding on various Coccids [*cf. R.A.E.*, A **24** 218]. Five generations were reared in outdoor cages during a year ; maximum emergence of the adults took place at the beginning of March, between 15th and 20th May, in early July, between 10th and 15th August and in early October. The durations of the egg and pupal stages varied from 5 to 9 and 6 to 15 days, according to the time of year, and the larval stage lasted 14–19 days in summer, 42–51 days in spring, and up to 132 days for the overwintering generation. The eggs were laid in groups of 3–4 on the ovisac of the Coccid ; the largest number deposited by a single female was 78, but dissection showed this individual to contain a further 26 eggs. The larva entered the ovisac and fed on the eggs and the body of the parent female, finally consuming the exoskeleton of the latter. They pupated in silken cocoons covered with frass or other débris among or near the remains of the Coccid.

LEPESME (P.) & PAULIAN (R.). **Sur la présence de** *Metamasius sericeus* **Ol. dans l'ouest africain (Col. Curculionidae).**—*Bull. Soc. ent. Fr.* **46** no. 3 pp. 31–37, 13 figs., 3 refs. Paris, 1941.

Three adults of *Metamasius sericeus*, Ol., with larvae and pupae, were found in the trunks of bananas at two places in the French Cameroons and there is an example from the Gabon in the collection of the Paris Museum. It thus appears that this weevil, which was probably introduced with plants from central America, is now acclimatised in western Africa. In view of its importance as a pest of banana in tropical America, its biology is reviewed and the larva, pupa and adult are described.

LEPESME (P.) & VILLIERS (A.). **Cérambycides récoltés par P. Lepesme, sur caféier, en A.E.F. et au Cameroun.**—*Bull. Soc. ent. Fr.* **46** no. 6 pp. 74–79, 4 figs., 8 refs. Paris, 1941.

A list is given of 23 Lamiids and a Cerambycid collected on coffee (*Coffea* sp.) in French Equatorial Africa and the Cameroons, with information on their food-plants and the distribution of some of them. The Lamiids include

Ochropyga lepesmei, sp. n., which is described by A. Villiers from a female taken on *Coffea robusta* in the Middle Congo in July 1939. Adults of *Bixadus sierricola*, White, the most injurious pest of coffee in western Africa, were rare at Atok, in the Cameroons, but larvae were very abundant in unhealthy plants of *C. arabica* cultivated at an unusually low altitude. Larvae were found in the branches of *Musanga smithii* and other trees in the secondary forest round an infested plantation in the Gabon. The larva and pupa are described.

CAIRASCHI (E. A.). *Pentalonia nigronervosa* **Coquerel (Hem. Aphididae) espèce nuisible nouvellement introduite en France.**—*Bull. Soc. ent. Fr.* **46** no. 9 pp. 138–140, 2 figs., 9 refs. Paris, 1942.

The author reports the occurrence of *Pentalonia nigronervosa*, Coq., in glasshouses in Rouen, where it was found in 1940 on banana and also on *Hedychium gardnerianum* and *Alocasia* spp. He gives lists of its recorded food-plants and the countries in which it occurs and a brief note on its relation to virus diseases [*cf. R.A.E.*, A **31** 294]. No evidence of such diseases was observed in the glasshouses.

VAYSSIÈRE (P.). **Un charançon nouveau (Col.) nuisible au filao en Indochine.**—*Bull. Soc. ent. Fr.* **46** no. 10 pp. 148–150, 4 figs., 1 ref. Paris, 1942.

The principal characters of the adult of *Sepiomus casuarinae*, sp. n., are described by A. Hustache, and those distinguishing it from the other species of the genus are given by the author. This weevil was found on the coast of northern Annam in plantations of filao [*Casuarina*], where it fed on the terminal buds of the young trees. Many of the trees died as a result of the injury. The damage was first observed in 1932, and it is considered that *S. casuarinae* is probably an indigenous species that has become adapted to *Casuarina*.

HOFFMANN (A.). **De la durée d'incubation des oeufs chez** *Anthonomus pyri* **Kollar (Col. Curculionidae).**—*Bull. Soc. ent. Fr.* **49** no. 1 p. 16, 3 refs. Paris, 1944.

It has been stated in French text-books that eggs of *Anthonomus piri*, Koll., laid in the buds of pear in the autumn, do not hatch until the following February or March, but the author has observed eggs as early as mid-September, young larvae in early October and perfectly formed adults at the beginning of March in Northern France. He considers it likely, therefore, that the early eggs hatch in about 20–30 days, and the later ones (deposited between mid-October and the end of November) not until the following spring [*cf. R.A.E.*, A **26** 761–762].

POUTIERS (R.). **A propos de la cochenille du mûrier,** *Diaspis pentagona* **Targ.**—*Bull. Soc. ent. Fr.* **49** no. 2 pp. 30–31. Paris, 1944.

The author briefly reviews the spread in southern France of *Pseudaulacaspis* (*Diaspis*) *pentagona*, Targ. [*cf. R.A.E.*, A **28** 388], which has now been found in parts of Gard, where mulberry is important to the silk industry. In addition to the principal known food-plants, he gives a list of those on which the scale was found at Neuville-sur-Saône, near heavily infested mulberries. They include beet, Jerusalem artichoke [*Helianthus tuberosus*], apple and grape vine, and a number of wild plants, and are considered of importance in assisting the survival and possibly the spread of the Coccid. The Aphelinid parasite, *Prospaltella berlesei*, How., introduced into France at about the same time as the scale, gives some control, but is not effective early in the season.

CLÉMENT (P.). **Quelques Coléoptères des bananes séchées.**—*Bull. Soc. ent. Fr.* **49** no. 10 pp. 125–127, 4 refs. Paris [1945].

Dried bananas from the Ivory Coast examined at Marseilles in October 1942 were found to be infested by the Nitidulids, *Carpophilus dimidiatus*, F. [*cf. R.A.E.*, A **15** 662], and *C. obsoletus*, Erichson, the larvae of which tunnelled in the dried fruits, and the Cucujids, *Oryzaephilus surinamensis*, L., *Ahasverus advena*, Waltl, and *Laemophloeus minutus*, Ol., the Trogositid, *Lophocateres pusillus*, Klug, and the Tenebrionid, *Tribolium castaneum*, Hbst., the larvae of all of which appear to feed only on damaged tissues.

MESNIL (L.) & D'AGUILAR (J.). **Parasitisme de** *Macquartia grisea* **Fall. (Dipt. Larvaevoridae) sur le doryphore.**—*Bull. Soc. ent. Fr.* **50** no. 2 p. 32. Paris, 1945.

Meigenia mutabilis, Fall., having been observed making unsuccessful attempts to parasitise the larvae of *Leptinotarsa* [*decemlineata*, Say] in France [*cf. R.A.E.*, A **27** 194], the authors tried to induce parasitism of this Chrysomelid by *Macquartia grisea*, Fall. Larvae of this Tachinid were deposited on the body of the host larva and penetrated into the underlying tissue, leaving only the posterior tracheal tubes exposed. These were soon surrounded by a chitinised pad, and the reaction of the host was such that this finally covered the end of the parasite completely so that it died from suffocation.

LEPIGRE (A.). **La désinfection des fruits frais parasités par le pou de San José.**—*Fruits Primeurs Afr. N.* **15** no. 162 pp. 196–204, 10 graphs. Casablanca, 1945.

In 1941, when the presence of the San José scale [*Quadraspidiotus perniciosus*, Comst.] in Algeria was confirmed, investigations were begun on its destruction on freshly harvested fruits by fumigation with methyl bromide, usually applied at the rate of 5 oz. per 100 cu. ft. free space with 20 oz. carbon dioxide. The mixture and air were introduced into a container with a vacuum of 670 mm. mercury until the vacuum fell to 20 mm. After exposure for the desired period, air was admitted to restore atmospheric pressure and withdrawn to give a vacuum of 650 mm. twice, after which it was allowed to enter again.

In the preliminary tests on the effect of fumigation on the fruits themselves, plums just beginning to change colour were ripe three days after exposure for 45–90 minutes, at temperatures of 25–27°C. [77–80·6°F.], whereas untreated fruit required 11 days to reach the same degree of ripeness. The prematurely ripe fruits were as good in quality as normal ones. Similar but less even results were obtained with plums in a more suitable condition for export (rather less ripe). Half the treated fruits and only 8 per cent. of the untreated fruits ripened in six days. In more detailed laboratory tests, in 1942, plums of several varieties were treated at temperatures of 24·5–31°C. [76·1–87·8°F.] with the same dosage and vacuum technique and exposures of 35–120 minutes. Premature ripening occurred only in certain varieties and seemed to be most marked in the latest ones. The effect usually began to appear 2–3 days after treatment and progressed steadily. These results were confirmed by experiments on a commercial scale with packed fruit, which showed that the rate of ripening of medium-late plums was doubled between the second to third days after fumigation. In comparative tests with hydrocyanic acid gas, exposure for 45 minutes to a dosage of 0·5 oz. per 100 cu. ft. at 26°C. [78·8°F.] had no adverse effect on plums of two varieties, one of which was susceptible to acceleration of ripening by methyl bromide.

In laboratory tests carried out under the same conditions as before, apricots exposed to 5 oz. methyl bromide per 100 cu. ft. for one hour at 28·5°C. [83·3°F.] showed no damage and no acceleration of ripening. When ripe apples imported from France were fumigated with a dosage of 8 oz. methyl bromide per 100 cu. ft. without carbon dioxide for 100 minutes and then kept at 25°C., they were slightly sweeter and more appetising in appearance a month after exposure than untreated fruits. Cut surfaces browned more rapidly in treated than untreated apples during the first 15–20 days after treatment, but less rapidly a month after.

Examination six days after fumigation showed that a dosage of 5 oz. methyl bromide and 20 oz. carbon dioxide per 100 cu. ft. for 30 minutes at about 25°C. gave complete mortality of all stages of *Q. perniciosus* on plums. Hydrocyanic acid gas gave complete mortality of all stages on twigs of apple and pear at a dosage of 0·125 oz. per 100 cu. ft. total space for 45 minutes at 22·5°C. [72·5°F.]. No trace of hydrocyanic acid was found in plums one day after treatment with 0·5 oz. per 100 cu. ft.

The use of hydrocyanic acid gas for the fumigation of plums is at present prohibited in Algeria, but the author considers that it would be preferable to methyl bromide for this purpose since it is cheaper and could be used on fruit for export.

BRICHET (J.). **La lutte contre le *Capnodis* dans le Sud-marocain.**—*Fruits Primeurs Afr. N.* **15** no. 162 pp. 219–220. Casablanca, 1945.

The author does not agree with the suggestion that apricot trees in southern Morocco would be less liable to attack by *Capnodis tenebrionis*, L., if grafted on to a root stock of bitter almond [*cf. R.A.E.*, A **24** 800], as he has often found various plants on bitter-almond stocks completely destroyed [*cf.* **33** 384]; moreover, almond is not a suitable stock for apricot. He considers that the best method of control consists in planting only uninfested and vigorous trees and in providing them with healthy conditions. Painting the lower part of the trunk in April and July–August with strong milk of lime containing one per cent. lead arsenate largely prevents injury to young trees.

JENKINS (C. F. H.). **The Citrus Red Scale.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 1 pp. 10–18, 8 figs., 3 refs. Perth, W.A., 1945.

A brief account is given of the bionomics and control of *Aonidiella aurantii*, Mask., on *Citrus* in Western Australia, where it is of only local importance and is readily controlled. The application of oil sprays is the measure most usually adopted, but fumigation with hydrocyanic acid gas is also employed to some extent and a combination of the two methods is very effective [*cf. R.A.E.*, A **27** 292]. The main breeding season lasts from November to May and several generations develop during that period. In addition to *Citrus*, *A. aurantii* has been found locally on fig, mulberry, rose, apple, pear, plum, nectarine, grape-vine, white cedar [?*Melia dubia*], zamia palm [?*Macrozamia*] and castor [*Ricinus communis*]. It is thought to be held in check partly by climatic conditions, since rainfall is heavier than in other parts of Australia where it is more injurious, and partly by the parasite, *Aphytis chrysomphali*, Merc., which was introduced from China in 1905 and has become widely established. Another introduced parasite, *Comperiella bifasciata*, How., was liberated in four districts in February 1943 [*cf.* **33** 322], but has not been recovered.

JENKINS (C. F. H.). **The Pear Slug.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 1 pp. 41–42, 1 fig., 2 refs. Perth, W.A., 1945.

Caliroa limacina, Retz., is well established in the temperate parts of Australia. In Western Australia, where cherry is rarely cultivated, it feeds chiefly on pear,

but also attacks plum, and has been recorded from almond, walnut, quince and hawthorn [*Crataegus*]. The appearance of the adult and larva and the nature of the injury to the leaves are briefly described and the life-history outlined from work in New South Wales and Tasmania [*R.A.E.*, A **25** 79 ; **27** 21]. A spray of 2 lb. lead arsenate powder in 100 gals. water or, where a lead-arsenate residue is undesirable, one containing ¾ pint nicotine sulphate and 3 lb. soap in 100 gals. water is recommended for control. Slight infestations can be controlled by applications of soot, slaked lime or road dust, but special measures are rarely necessary if lead-arsenate or nicotine sprays are applied in spring against other insects.

JENKINS (C. F. H.). **Some Household Pests—dried Fruit and Meal Insects.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 1 pp. 49–51, 4 figs. Perth, W.A., 1945.

Very brief notes are given on the habits of insects that infest foodstuffs stored in houses in Western Australia ; they include *Calandra oryzae*, L., which sometimes attacks macaroni and spaghetti as well as grain and *Plodia interpunctella*, Hb., *Ephestia kuehniella*, Zell., and *E. cautella*, Wlk., which occur in dried fruit and other groceries. The purchase of commodities in small quantities and their storage in insect-proof tins or jars are recommended to prevent infestation. Insects in small quantities of foodstuffs can be destroyed by slowly heating the infested material in an oven, in which the temperature should be raised to 140–150°F. in about one hour, or, in summer, by spreading it in a thin layer on an iron plate in the sun. Larger quantities should be fumigated for 48 hours in a gas-tight bin with carbon bisulphide applied at a rate equivalent to 4 lb. per 1,000 cu. ft. space.

JENKINS (C. F. H.). **Entomological Problems of the Ord River Irrigation Area.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 2 pp. 131–145, 4 figs. Perth, W.A., 1945.

This is a preliminary report on the insect pests that occur in the Ord River Irrigation Area, in the north of Western Australia, based mostly on observations between 17th April and 15th July 1944 ; rather more than half of it deals with pests of plants. An unidentified Jassid that severely damaged lucerne in October–November, but was not collected during the survey, is regarded as the most serious pest of pasture plants at Carlton Reach. *Gastrimargus musicus*, F., *Austracris guttulosa*, Wlk., and *Locusta migratoria*, L., all swarm in the area, but they are not injurious every year and only the first two were collected. They are likely to be less injurious to pasture land than to cultivated crops when the grass is drying up ; *G. musicus* caused considerable damage to plants in experimental plots at Carlton Reach in March–April, 1944. Vegetable crops are also attacked by three leaf-eating beetles, *Epilachna vigintioctopunctata*, F., *Aulacophora hilaris*, Boisd., and an unidentified Chrysomelid. They apparently prefer cucurbits, but feed on many other plants, including lucerne, and are considered to be indigenous, since they are widely distributed on wild cucurbits and other plants. They can be controlled by arsenical dusts and sprays, but derris is recommended for use on very young plants, which are sometimes injured by arsenicals. *Hymenia recurvalis*, F., which severely damages beets in the south-western regions, is widely distributed in the northern area and was reported to be troublesome in some gardens. The larvae were observed feeding on wild *Amarantus*. *Citrus* is grown at many places and the fruit-piercing moth, *Othreis materna*, L., was found in several localities. It was stated to appear sporadically in large numbers and damages most of the ripe fruit present. Menispermaceous vines [*cf. R.A.E.*, A **33** 291] occur in the region, but the larvae apparently feed on other plants also, since the moths are found further south than these vines and cannot all have been carried by wind.

No cotton was growing in the area at the time of the survey, but *Heliothis armigera*, Hb., and *Earias huegeli*, Rogenh., were collected, and *Platyedra gossypiella*, Saund., *Dysdercus sidae*, Montr., and *Oxycarenus luctuosus*, Montr., have been recorded further to the west ; wild malvaceous plants were abundant.

Mastotermes darwiniensis, Frogg., is the most injurious termite and causes extensive damage to wooden buildings and cultivated plants and trees. *Hamitermes rubriceps*, Frogg., and *Eutermes triodiae*, Frogg., were also observed ; they do not attack trees or timber, but their mounds may be of importance in connection with landing grounds for aircraft. Timber that is relatively resistant to termites is produced by *Callitris intratropica*, *Eucalyptus microtheca*, *Melaleuca leucadendron* and *Hakea arborescens*.

Precautions that should be taken to prevent the introduction of insect pests into the area are suggested, and a list of the insects collected during the survey, many of which are undetermined, is appended.

LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **16** no. 2 pp. 46–49, 17 refs. Suva, 1945.

The Ichneumonid, *Nemeritis palmaris*, Wlkn., which was introduced into Fiji against *Coleoneura* (*Tirathaba*) *trichogramma*, Meyr. (coconut spike moth) in 1933 [*R.A.E.*, A **23** 608] and liberated on Taveuni and other islands, was reared in March 1945 from cocoons of the moth collected on a felled coconut palm in southern Taveuni. The cocoons were not abundant, evidently owing to the activities of this parasite and of the Tachinid, *Erycia basifulva*, Bez. [*cf. loc. cit.*], which also appears to be well established. Both parasites had been collected in northern Taveuni in 1937 [**26** 334].

In a list of errata (p. 60), the scientific name of Chinese radish, cited in a recent paper as a food-plant of *Crocidolomia binotalis*, Zell. [*R.A.E.*, A **34** 101], is corrected from *Brassica sativus hortensis* to *Raphanus sativus hortensis*.

GADD (C. H.). **Observations on the Yellow Tea-mite *Hemitarsonemus latus* (Banks) Ewing.**—*Bull. ent. Res.* **37** pt. 2 pp. 157–162, 7 refs. London, 1946.

From a brief review of the literature, it is shown that the name *Tarsonemus translucens*, Green, commonly applied to the yellow mite of tea in Ceylon [*R.A.E.* A **25** 334, etc.], cannot be used as it is preoccupied in *Acarus*, the genus in which the mite was originally described. The mite is, however, identical with *Hemitarsonemus* (*Tarsonemus*) *latus*, Banks, and this is the next available name for it. The life-cycle of the mite, all stages of which are briefly described, lasted 4–6 days in March–May. Experiments were carried out in the laboratory to ascertain whether the nymphs carried by the males on the genital papilla are females that are about to become adult [*cf.* **29** 321 ; **31** 298]. When 12 males each bearing a nymph were placed on uninfested tea shoots, the nymphs had all developed into adult females by the next day. The males were then destroyed, and on the following day 1–4 eggs were found on each shoot. Two of the females died on the second day of adult life, but oviposition records were kept for the other ten. They survived for 6–15 days, with an average of 10, and deposited in all 363 eggs. The maximum laid by a single female was 56 in 12 days, and the minimum 10 in six. Of 197 mites that were reared from these eggs, 158 were females and 39 males. A further experiment showed that unfertilised eggs give rise to males only, and it is therefore concluded that most or all of the ten females had been fertilised. Mating was not observed, but evidently takes place under normal conditions soon after the females become adult. It may occur later, however, since two of four females that were known to be unfertilised and had been ovipositing for eight days laid eggs that gave rise to females after males had been placed on the shoots with them. From the results of the

first experiment and the observed selection of particular nymphs by males in the field, the author concludes that only females that are about to become adult are transported by the males.

Colonies of the mite occur on the two or three young leaves round the unopened buds and move from them as they become old to younger leaves, although only the males are active. As the males carry only one nymph at a time and tend to transport it to young leaves, which may be too far away for them to return, the proportion of unfertilised females in the original colony increases and since their progeny are all males, which in turn migrate, with or without nymphs, the original numbers are gradually reduced.

HILLE RIS LAMBERS (D.). **The Hibernation of *Myzus persicae*, Sulzer, and some related Species, including a new one (Hemipt. Aphidae).**—*Bull. ent. Res.* **37** pt. 2 pp. 197–199, 8 refs. London, 1946.

It is generally accepted that *Myzus persicae*, Sulz., overwinters in the egg stage on peach and nectarine, but eggs have also been recorded on cabbage [*R.A.E.*, A **10** 414], *Daphne* [*loc. cit.*], rose and *Prunus nigra* [**31** 129]. The author has observed in Holland that the alate gynoparae migrate in late summer and autumn to various species of *Prunus*, without special preference, and give rise to oviparae, but that the males, which also migrate in numbers to *Prunus* spp., and pair with the oviparae, apparently prefer peach. The oviparae deposit fertilised eggs on all species of *Prunus*, chiefly on the older branches and the trunk, and these hatch in spring, but the immature fundatrices complete their development only on peach. Records of oviparae or of eggs on other plants do not therefore necessarily indicate survival of the species as a result of overwintering in the egg stage.

Both red and green forms of *M. persicae* have been recorded, but the apterous viviparae are always green in Holland. An Aphid that closely resembles *M. persicae*, but of which the apterous viviparae are red, is locally common on *Dianthus deltoides* and related plants, on which it overwinters in the egg stage, and is here described as *M. caryophyllacearum*, sp. n. *Aphis dianthi*, Schr., a green Aphid that feeds on *Dianthus* spp., is stated in a footnote to be true *M. persicae*. Another red Aphid is common on *Viola arvensis* and resembles *M. caryophyllacearum* very closely, but the males did not mate with unfertilised oviparae of the latter, and the author considers that it is *M. certus*, Wlk. *M. caryophyllacearum* and *M. certus* both have apterous males. They both transmit a leaf-curl disease to their food-plants, but they are not considered of economic importance as vectors of viruses, since they do not attack potato sprouts, tulip or beet. With *M. ajugae*, Schout., a green Aphid that is restricted to *Ajuga reptans* and is rare in Holland, they are considered to represent non-migrating species that have separated from an original migrating form, and the species commonly known as *M. persicae* probably comprises several entities differing in biology and in capacity to transmit viruses.

GOUGH (H. C.). **Studies on Wheat Bulb Fly (*Leptohylemyia coarctata*, Fall.). I. Biology.**—*Bull. ent. Res.* **37** pt. 2 pp. 251–271, 3 figs., 14 refs. London, 1946.

The results are given of a laboratory and field investigation in 1943–45 on the bionomics of *Hylemyia* (*Leptohylemyia*) *coarctata*, Fall. [*cf. R.A.E.*, A **16** 298, etc.] in Yorkshire where it had caused poor crops and occasional failures of wheat and rye in many districts for several years. Injury occurs when cereal crops follow second early or main-crop potatoes on light, sandy soil and fallows on very heavy soil. The eggs are laid in summer and hatched in late January or early February. In view of this hatching date, spring wheat sown towards the end of February is almost certain to escape infestation. Eggs in soil in pots

out of doors did not hatch when the minimum temperature was 27°F. or less, but withstood severe frost. Larvae from eggs buried as deep as 18 ins. [*cf.* **34** 216] successfully attacked wheat plants. The larvae almost always enter the stem through the basal node and within 24 hours cause decomposition and discoloration that is visible from the outside when the outer sheaths are removed. They move spirally upwards for about an inch and then settle in the central hollow of the shoot, at first they remain below the level of the soil, but later may occur above it. The symptoms shown by the central shoot vary and may comprise stunting, wilting, browning of the tip, or a combination of all three.

In the field, damaged plants were first found in early February in both 1944 and 1945, and it was evident that some eggs had survived flooding. A snow cover prevented observations between 14th February and 10th March in 1944, but the numbers of plants infested and of larvae per acre had reached their maximum by the latter date, though the development of the larvae had been retarded. They began to leave the plants at the end of April, and almost all had pupated by 9th May. In 1945, when the weather in March was much warmer, practically all the larvae had pupated by about the third week in April, except in one district where the soil was very heavy and more than half the larvae did not pupate until May. In 1944, the percentage of damaged shoots containing larvae decreased from the beginning of March, at which time the larvae were migrating to uninfested shoots, generally on the same plant. First-instar larvae apparently descend to the base of the plant to enter a new shoot, but older ones pass directly from one shoot to another if these are enclosed in a common sheath. Third-instar larvae were able to travel a distance of 18 ins., the maximum tested, through the soil. Several larvae were frequently found in one shoot, but observations indicated that only one survives.

An experiment confirmed observations that oats are attacked only to a slight extent and that larvae that enter them quickly die. Barley was apparently attacked normally in the laboratory and the larvae survived in it up to the second instar, but relatively few are thought to have completed their development. Larvae were found in *Poa trivialis*, *P. annua*, *Agrostis alba* var. *repens* and *Agropyrum repens*, and infested *Phleum pratense* and *Lolium perenne*, but not fine grasses, in the laboratory. Larvae developing in *Dactylis glomerata* reached the third instar, but the food-plant then died.

In 1944 and 1945, the peak of adult emergence occurred about mid-June, the males appearing a few days before the females. Emergence was rather later on heavier soil. In preliminary observations in 1943, maximum catches of adults, among which males predominated, were made on 8th June, after which numbers fell rapidly, owing at first to the disappearance of the males ; in mid-July, however, relatively large numbers of males were observed in an oat field and on one occasion in a potato field. In the following year, the sex ratio varied in a similar manner, and reached equality about the end of June ; no males were observed after 10th August. In one field, populations were considerably higher along one edge than elsewhere ; this difference was apparently not due to sun, wind, or a difference in population of larvae. The flies appeared to disperse gradually and at random from the fields in which they emerged. They paired about three weeks after emergence, and dense aggregations of flies, consisting mostly or entirely of males, were observed at that time. The first eggs were laid soon afterwards and oviposition continued for about a month. Field-collected females deposited an average of 22·5 eggs, with a maximum of 50. The eggs were laid singly or in groups of 2–3 immediately below or on the surface of loose soil and on medium-sized particles of soil beneath the large clods on heavy soil undergoing fallow. In view of the long maturation period of the eggs, the food of the female may be of importance. Females in the laboratory, where conditions were rather hot and dry, were given cane sugar,

glucose, dried milk, or meat extract, alone and in mixtures, but cane sugar was the only food that enabled them to live for more than a few days, and those given it died in less than three weeks without any indication of their ovaries maturing.

RIVNAY (E.). **Ecological and physiological Studies on *Capnodis* spp. (Col., Buprestidae) in Palestine. III. Studies on the Adult.**—*Bull. ent. Res.* **37** pt. 2 pp. 273–280, 4 figs. London, 1946.

In this part of a paper on the bionomics of Buprestids of the genus *Capnodis* in Palestine [*cf. R.A.E.*, A **33** 75, 384], the results are given of observations in 1936–43 on the adults of *C. carbonaria*, Klug, *C. tenebrionis*, L., and *C. cariosa*, Pall. The first two were reared from eggs in the laboratory, but as the females thus obtained died without ovipositing, examples collected from almond and other stone fruits were chiefly used. Adults of *C. cariosa* were taken on *Pistacia*. The females were caged individually with males, and the food was almond twigs. Females of *C. carbonaria* collected in April and May in 1938 and 1939 and kept in the laboratory at 20–30°C. [68–86°F.] oviposited after ten weeks, but others kept out of doors where the temperature was 12–41°C. [53·6–105·8°F.] did so after 30–40 days. Oviposition continued in all three species, at intervals throughout adult life. Many females did not oviposit or laid less than 50 eggs, but others deposited many hundreds. The highest figures recorded were 2,971 for *C. carbonaria*, 1,696 for *C. tenebrionis* and 999 for *C. cariosa*, the females in question living for 353, 395 and 170 days, respectively. The optimum temperature for oviposition was 30–34°C. [86–93·2°F.]. Of 30 females of *C. carbonaria* that were each caged with two males, 15 kept at 26–30°C. [78·8–86°F.] laid a total of 1,271 eggs, whereas 15 kept at 30–40°C. [86–104°F.] laid 7,165. Observations over a period of six years indicated that the lowest temperature at which females of *C. carbonaria* and *C. tenebrionis* oviposit is approximately 26°C.; females of *C. cariosa* oviposited at 24°C. [75·2°F.].

Observations on females reared out of doors showed that oviposition normally begins in May, increases until the end of August, and ceases in early October. Females that began to oviposit in June sometimes deposited all their eggs in one summer, and these were the most prolific, but oviposition sometimes extended over two summers, and females that become mature in late July or August laid few or no eggs until the following year.

Eggs could not be found in the field and none had been observed by growers while removing larvae from the roots of trees. To ascertain whether they are laid on the trunks or branches, two females of *C. carbonaria* were placed in a bottomless cage enclosing a young plum tree. They were prevented from entering the soil by covering it with a dark cloth, and most eggs were deposited between the walls of the cage and the cloth, some in a fold of the cloth and only two on the trunk. It is concluded that crevices between the trunk and the surrounding soil provide suitable sites for oviposition, a view supported by the fact that young larvae are usually abundant near the root crown and that infestation is most severe at this point. Larvae found at short distances from the trunk probably hatch from eggs laid in crevices between the soil and pieces of rock, etc., projecting from it, since they do not as a rule migrate before entering the soil. A few eggs were sometimes deposited on the twigs or leaves in the laboratory, and the larvae that hatched from them dropped to the ground. Some, however, may drop into the forks of branches; several galleries have been observed in forks of main branches in the field, but the damage caused was unimportant. No conclusions were reached regarding the total duration of adult life, but some field-collected adults of *C. carbonaria* and *C. tenebrionis* survived for over a year and two examples of the latter for nearly two years. The adults feed on the bark of soft twigs, the twig buds, which are preferred, and the stalks of the leaves surrounding the buds, and

their presence is indicated by the occurrence of fresh leaves on the ground beneath the trees. They shelter in the soil during cold, damp weather in winter, but rest in the sun on the bark of the trees on warm days.

WILSON (A. R.). **A Machine for Nicotine Fumigation of Field Plots.**—*Bull. ent. Res.* **37** pt. 2 pp. 281–290, 2 pls., 7 figs., 1 ref. London, 1946.

The following is mainly the author's summary. The construction of an inexpensive, simple, hand-drawn fumigator for field plots is described and illustrated. The principle employed is the injection of liquid nicotine under pressure into the exhaust system of a two-stroke engine, close to the port. The liquid is vaporised by the heat of the exhaust stream and distributed by it below a drag sheet at the rear of the machine. The machine is of simple and robust construction utilising standard plumbing fittings, angle iron, strip iron and second-hand motor-cycle parts. It is self-contained and can be towed behind a car from place to place. It is suitable for use on a wide variety of crops, since the track is variable between 43 and 67 ins. and the clearance between 16 and 34 ins. With a drag sheet 18 ft. in length it can fumigate, in good conditions, one acre in about five hours, the amount of nicotine required being usually about 1½–1¾ pints per acre. The use of a lightweight sheet about 54 ft. long would decrease the time required per acre to about 1¾ hours and would enable the machine to be drawn by a tractor if desired, though the engine would have to be run at a higher speed ; these suggestions have not, however, been tried.

The machine has been used successfully to kill Aphids infesting sugar-beet seed and root crops and potatoes in England during the past four years, and tests of performance on experimental plots showed percentage mortalities of 88, 93 and 99. One fumigation has been sufficient to control Aphids introduced experimentally to infect sugar beet with virus-yellows [*cf. R.A.E.*, A **34** 113], but as re-infestation from natural sources is often rapid, frequent fumigation may be necessary if it is desired to maintain the Aphid population at a low level over a long period.

CHABOUSSOU (F.). **Sur deux rynchites (*R. bacchus* L. et *R. aequatus* L.) nuisibles aux arbres fruitiers en Agenais.**—*C. R. Acad. Agric. Fr.* **31** no. 3 pp. 110–112, 4 refs. Paris, 1945.

The results are given of investigations on the weevils, *Rhynchites bacchus*, L., and *R. aequatus*, L., carried out in Lot-et-Garonne. Adults of *R. bacchus* damage fruit trees both by maturation feeding and by oviposition. They overwinter under the bark or in dead wood and appear at the end of March, first on plum and cherry plum [*Prunus divaricata*] and later on pear. They feed on the buds, shoots and flowers and later on the fruits until the middle of May, when they migrate to other trees. Mating occurs in the second half of April, and the eggs are laid about a week later in plums, cherries, apples, nectarines, and more rarely pears or peaches. The fruit stems are partially cut by the female in the course of oviposition, and some of the fruits fall to the ground. The feeding punctures do not lead to decay, but oviposition is practically always followed by attack by the fungus, *Sclerotinia* (*Monilia*) *fructigena* [*cf. R.A.E.*, A **25** 505, etc.] ; this may appear in green fruits in spring, and is particularly injurious on nectarine. Infected fruits may contaminate others in contact with them on the tree, and the fungus spreads through the peduncle to the branch.

R. aequatus has been observed on plum, on which it causes injury similar to that due to *R. bacchus*. It is not known whether it is also a vector of *S. fructigena*. Both weevils are most abundant under dry conditions. Arsenicals have not given good control, but contact insecticides, such as rotenone and

organic compounds, gave promising results in preliminary laboratory and field tests, and treatment in winter with organic nitro-compounds gave 62 per cent. mortality of adults hibernating under the bark.

HUBAULT (E.). **Forêt landaise 1945.—Invasions d'insectes.**—*C. R. Acad. Agric. Fr.* **31** no. 8 pp. 415–420, 5 refs. Paris, 1945.

As a result of fires and exploitation during the war, the forests of the Landes and Gironde, which are composed of *Pinus pinaster*, now contain many dead and dying trees and stumps that attract injurious insects. These have been doing much damage since 1944, and a survey carried out in May 1945 showed that the most common and destructive of all was *Ips sexdentatus*, Börn., which generally infests weakened trees, but attacks and destroys healthy ones when it is abundant. Other injurious Scolytids were *Ips erosus*, Woll., and *I.* (*Pityogenes*) *bidentatus*, Hbst., which also damage the cambium, *Myelophilus minor*, Htg., and *M. piniperda*, L., which are only occasionally injurious, and *Xyleborus eurygraphus*, Ratz., which, though only a secondary pest, causes serious damage to the wood by its boring. The adults of *Hylobius abietis*, L., and the larvae of *Pissodes notatus*, F., are injurious to young trees, and, although not directly affected by fires and exploitation, the Pyralid, *Dioryctria splendidella*, H.-S., and the Notodontid, *Thaumetopoea pityocampa*, Schiff., are increasing and have caused considerable damage.

Notes are given on the bionomics of the most important of these insects, and on the control of the Scolytids by barking trees and tree stumps immediately after felling, of *P. notatus* by burning trees showing red needles before the emergence of the adults and of *H. abietis* by barking the stumps, or by dusting with arsenicals against the adults.

It is suggested that in the course of reconstructing these forests, which is considered an immense and complicated task, they should be transformed to mixed forest by the introduction of suitable species of trees, in order to limit damage by fire and insects.

MCDONALD (J.). **Annual Report of the Director of Agriculture (Cyprus) for the Year 1944.**—12 pp. multigraph. Nicosia, 1945.

It is stated in the course of this report that *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., which was first found in Cyprus in 1940, has become established as an important pest of *Citrus* in three districts and also occurs in a fourth. Large quantities of white oil and lime-sulphur were supplied to growers in 1944, and groves over an area of 1,300 acres were sprayed, with satisfactory results.

PASTRANA (J. A.). **La mariposita europea del brote del pino** *Rhyacionia buoliana* **(Schiffermüller).** [The European Pine Shoot Moth, *R. buoliana*.]—[*Publ.*] *Inst. Sanid. veg.* (A) **2** no. 15, 11 pp., 2 col. pls., 15 refs. Buenos Aires, 1946. (With a Summary in English.)

Rhyacionia buoliana, Schiff., was first observed in Argentina in 1939, having presumably been introduced with pine seedlings from Europe or the United States. It is still confined to ornamental pines, principally *Pinus radiata* (*insignis*), in nurseries and gardens in the vicinity of Buenos Aires. Its geographical distribution and the principal literature on it are reviewed, and all stages are briefly described. It has not yet caused much damage in Argentina, but is of potential importance there, as pine plantations are extensive. The eggs are laid singly on the young terminal shoots during November and December, and the larvae hatch in a few days and tunnel into the shoots, where they overwinter. They leave their winter quarters in September and

October, as the weather becomes warmer, and attack adjacent shoots, feeding in one after another. Most of these shoots die, but some survive in a deformed condition. Pupation occurs at about the end of September inside the shoots, and the adults emerge about 20 days later.

R. buoliana is attacked by numerous parasites in Europe [*cf. R.A.E.*, A **24** 755 ; **25** 593, etc.], but only one, an undescribed Ichneumonid of the genus *Nemeritis* (*Idechthis*), has been reared from it in Argentina. The chief method of control is the destruction of infested shoots ; others suggested are spraying with lead arsenate before the first larvae enter the shoots, weekly applications during the oviposition period of a spray of 2 pints nicotine sulphate and 1 gal. miscible oil in 100 gals. water to destroy the eggs, and the use of light-traps or bait-traps set up at tree-top height to catch the adults. The bait suggested consists of 2 oz. yeast, 1 pint molasses and 9 pints water.

PASTRANA (J. A.). **Una nueva mariposita en las coles de la República Argentina *Hellula phidilealis* (Walker) (Lep. Pyraustidae).** [A new Lepidopterous Pest on Cabbage in the Argentine Republic.]—[*Publ.*] *Inst. Sanid. veg.* (A) **2** no. 16, 8 pp. 2 col. pls., 7 refs. Buenos Aires, 1946. (With a Summary in English.)

Hellula phidilealis, Wlk., which has not previously been recorded in Argentina, has recently been found on cabbage in the Delta of the Paraná and in the provinces of Corrientes and Misiones. The distribution of this Pyralid is reviewed, all stages are briefly described and an account is given of its bionomics and control based largely on the literature [*cf. R.A.E.*, A **24** 769 ; **33** 95]. In the Delta of the Paraná and in Corrientes whole seed-beds have been destroyed by the larvae. Pupation in the former area occurred at the end of April, and a spray of lead arsenate during the oviposition period gave effective control on young plants. It is not recommended for use on full-grown cabbages, owing to the danger from toxic residues.

STRICKLAND (A. H.). **A Survey of the Arthropod Soil and Litter Fauna of some Forest Reserves and Cacao Estates in Trinidad, British West Indies.**—*J. Anim. Ecol.* **14** no. 1 pp. 1–11, 1 fig., 12 refs. London, 1945.

An apparatus for the extraction of the Arthropod fauna from soil samples by a flotation method is described, and the results obtained when it was used to analyse the fauna of the soil and litter in three forest reserves and four cacao estates in Trinidad during the rainy season of 1943 are given and discussed. The soil samples (3 ins. in depth and 3·6 in. in diameter) are first deflocculated where necessary by steeping for 20–24 hours in a semi-saturated solution of sodium chloride. Air is then bubbled through the soil sample in this solution to separate the organic matter, which is floated off on to a double layer of muslin, washed into a beaker with tap water, and boiled, causing the vegetable matter to sink and killing the animals present in an extended position. The Arthropods are allowed to collect at an interface produced by the addition of kerosene and decanted on to a muslin stretched taut across a photographic plate, from which they are removed under a low-power binocular microscope. Examination of the soil residue indicated that about 95 per cent. of the population was extracted by this process, and it is therefore considered accurate enough for preliminary surveys.

The Coccids, *Rhizoecus moruliferus*, Green, and *Ortheziopa* sp., and ants of four species *Acropyga* (*Rhizomyrma*), which tended them [*cf. R.A.E.*, A **33** 147] were found in relatively large numbers on the roots of cacao, especially on two estates on which the yield had decreased rapidly in recent years, and may have been partly responsible for the loss.

PHILLIPS (A. M.) & COLE (J. R.). **Insects and Diseases of the Pecan in Florida.**—*Bull. Fla agric. Exp. Sta.* no. 411, 62 pp., 43 figs., 2 refs. Gainesville, Fla., 1945.

About half of this bulletin contains short accounts of the bionomics and control of the insects that attack pecan in Florida, arranged somewhat in the order of their economic importance. The remainder comprises similar sections on diseases and one on the preparation and application of sprays against insects and diseases, including a spray programme for combined control. Much of the information on insect pests is given in a bulletin already noticed [*R.A.E.*, A **29** 159].

ARMITAGE (H. M.) & others. **Bureau of Entomology and Plant Quarantine.**—*Bull. Dep. Agric. Calif.* **33** no. 4 pp. 228–275. Sacramento, Calif., 1945.

By the end of 1944, the position with regard to *Cydia* (*Grapholitha*) *molesta*, Busck, in California was more favourable that at any time since it was first found in the State attacking peach in the autumn of 1942 [*R.A.E.*, A **32** 114]. There was no great increase in field populations in areas already infested [*cf.* **34** 108] and no alarming spread to uninfested areas. Road transport moving from the generally infested area in southern California to the north was inspected and the transport of used fruit boxes was forbidden unless they had been fumigated or sterilised with steam. Small infestations in northern California were surrounded by quarantine lines about half-a-mile from the centre of infestation, and all fruit and boxes were fumigated before being taken out of such areas. A few insecticides, including DDT, and several inert substances, gave promising control in laboratory tests. Nearly 20 millions of the parasite, *Macrocentrus ancylivorus*, Rohw., were produced [*cf.* **34** 305, etc.], and the parasites were liberated repeatedly throughout the summer within the quarantine lines in northern California and generally distributed over the more widely infested area in southern California. It was confirmed that the larvae of *C. molesta* are primarily twig-feeders on rosaceous plants, and succulent twig growth available throughout the season under irrigation in California may attract adults and larvae away from the fruit and thus minimise the economic importance of the moth. Only one new food-plant, *Photinia serrulata*, was found. Under experimental conditions the larvae developed in the ripe fruit of many soft fruits, but not in the twigs. There appear to be not more than five generations a year in California, the first lasting as long as 80 days, the second 35–40 days and the last three at least 29 days each. A federal survey of the western States showed a rapid decrease in the number uninfested. Infestations were found in Nebraska, Iowa, Kansas and Oklahoma in 1943 [**33** 258] and in Colorado, Utah and Idaho in 1944. About 50 other species of insects were taken in fruit-moth traps in California; these were the same as those collected in 1943 [*cf.* **34** 108], with the addition of a single adult of the apple and thorn skeletoniser (*Anthophila pariana*, Clerck); this is probably the first Californian record of this Tineid.

The eradication of *Dialeurodes citri*, Ril. & How., and *Melanaspis obscura*, Comst. [*cf.* **34** 108] is reported to be complete. Surveys in Stanislaus County, where only one infestation was found in 1943, showed that *Parlatoria oleae*, Colv., had spread to 32 new properties, where it occurred on the known food-plants, *Arbutus*, *Cotoneaster*, peach, ash, privet and rose. Spraying with 2 per cent. light-medium oil, followed by fumigation with hydrocyanic acid gas about ten days later and a second spraying next summer did not give satisfactory control, as live scale was present in all but one of the infested properties and on six adjacent ones that had not been infested before. Surveys of the infested areas near the San Joaquin River in Madeira County [*cf.* **34** 108] showed no living scale. In attempts to eradicate *Nilotaspis halli*, Green, first found

attacking peach in California in 1941, 108 dying or abandoned host trees were destroyed. All host trees on infested properties were repeatedly sprayed with oil, and in view of the difficulty of reaching the encrusted scale in the bark crevices on the trunks of the older trees, investigations on fumigation with hydrocyanic acid gas under tents were begun.

To protect beet and other crops from the curly-top virus [*Chlorogenus eutetticola* of Holmes] transmitted by *Eutettix tenellus*, Baker, vapour sprays of diesel oil containing 3 per cent. thiocyanates and 1 per cent. concentrated pyrethrum extract were applied between 1st November 1943 and 1st May 1944 to concentrations of the leafhopper on native food-plants in the foothills along the west side of the San Joaquin Valley. Over 1,300 acres of difficult terrain were treated with 5 U.S. gals. per acre. Destruction of Russian thistle [*Salsola*] between the foothills and the cultivated areas, where it favours the migrating leafhoppers, was continued from 1st May to 1st November. It is estimated that the size of the spring brood of leafhoppers over the whole Valley was reduced by 80 per cent., but they carried a very virulent form of virus, and the amount of crop damage was much larger in proportion to the leafhopper populations than in 1943. The season of 1944 was very favourable for the development of *E. tenellus*, as the average temperature was above normal with no unusual periods of warm weather during summer, and a dry warm October permitted development of a large overwintering generation. Heavy rain in June caused the growth of a large acreage of Russian thistle, but its control reduced the numbers of overwintering leafhoppers to a considerable extent, and rain in early autumn caused more scattering of adults than usual.

In three tests, fumigation with 2½ lb. methyl bromide per 1,000 cu. ft. for two hours under atmospheric pressure at 80–85°F. and 75 per cent. relative humidity gave complete kill of red scale [*Aonidiella aurantii*, Mask.] on *Citrus* nursery stock without damaging the plants, and in later ones the same treatment was equally effective against it on a wide range of *Citrus* and ornamental plants and infected fruits, but caused some injury to *Citrus* seedlings with bare roots that had partly dried out, to two *Citrus* trees of which the balls of soil round the roots had been broken and to two tree roses. Exposure of infested fruits to normal cold-storage temperatures of 34–36°F. for ten weeks gave complete mortality of all larvae of *Cydia molesta* in them. In preliminary tests, DD mixture (1,3-dichlorpropylene and 1,2-dichlorpropane) used at a concentration of 3·8 cc. per U.S. gal. water, gave promising results against *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., in lawns when penetration of several inches was possible.

Insects identified during the year included the Tachinid parasite, *Erynnia nitida*, R.-D., of the elm leaf beetle [*Galerucella luteola*, Müll.], previously established in San Joaquin County, which was abundant in one district of Merced County ; *Halticus bracteatus*, Say, taken for the first time in California on *Aralia* in Los Angeles County ; and *Apterona crenulella*, Brd., a minor pest of apple in the southern part of the Russian Union [*cf.* **4** 210], which was taken on filbert [*Corylus*] in Nevada County. *Tetranychus atlanticus*, McG., was taken on cotton, clover, walnut, lucerne and beans, and specimens of *Vasates* (*Phyllocoptes*) *destructor*, Keifer, were received from tomato in Colorado.

Surveys carried out near maritime ports where foreign pests might have been introduced and become established revealed the presence of *Aceria peucedani*, Can., damaging the seed heads of carrot at Rio Vista in July and August ; this is the first North American record of this Eriophyid. *Vasates* (*Phyllocoptes*) *eurynotus*, Nal., was associated with it, and also occurred on carrot and parsley in the Los Angeles area. *Limothrips cerealium*, Hal., a pest of cereals in Europe, was taken on tomato in June and on orchids in July. *Diaspidiotus ancylus*, Putn., was taken on black walnut [*Juglans nigra*], pecan and *Viburnum*, the Asiatic scale, *Lecanium kunoense*, Kuw., first reported on plum in 1941, was found on apple, plum and walnut in May and on pear and cherry in September

1944, and *Pollinia pollini*, Costa, first reported in California sixty years ago on olive trees, which were destroyed, was found in two counties in April and July. *Coccotrypes dactyliperda*, F., previously recorded in 1931, attacked the seed of the ornamental date palm (*Phoenix canariensis*) in three counties. Larvae of *Chilo loftini*, Dyar, a native of north-western Mexico, where it is a pest of sugar-cane and cereals, were found for the first time in California boring in sugar-cane, rice, sorghum, and grass in Imperial County, and also in *Canna* in Arizona, in November–December. The establishment of *Myelois venipars*, Dyar, is reported on the basis of specimens submitted from San Diego County, where larvae were feeding in mummified peaches and oranges. Larvae of *Spilonota ocellana*, Schiff., were collected from plum in Napa County in July ; adults were trapped as far south as Kern County. *Hylemyia cilicrura*, Rond., was apparently abundant in 1944, as larvae were repeatedly found damaging the central leaves of spinach ; they were also found on asparagus, cauliflower, turnip, beans and maize.

The report also includes sections dealing with the incidence of pests on various crops in different regions of the State and with pests intercepted at maritime ports, airfields and border inspection stations and within the State, and notes on revisions of State quarantine regulations.

Atkins (I. M.) & Dahms (R. G.). **Reaction of Small-grain Varieties to Green Bug Attack.**—*Tech. Bull. U.S. Dep. Agric.* no. 901, 30 pp., 9 figs., 12 refs. Washington, D.C., 1945.

A severe outbreak of *Toxoptera graminum*, Rond., caused widespread damage to barley, oats and wheat in central Texas, Oklahoma and southern Kansas in the early months of 1942 ; losses in the first two States were estimated at over 61 million bushels of grain. Oats and barley were damaged more severely than wheat and over a larger area. The outbreak began in central Texas, where excessive rainfall during the summer of 1941 had delayed harvest and caused extensive lodging. This resulted in the appearance of large numbers of self-sown plants on which large populations of the Aphid survived the summer. Favourable weather in autumn enabled it to increase rapidly, and temperatures in winter and early spring were in general not low enough to retard its development but were too low for normal development of its insect enemies ; it was also favoured by low winter precipitation. The food-plants grew slowly under these conditions and were severely damaged in February and March ; spring-sown plants were destroyed as they germinated. From 15th March, parasites increased rapidly in numbers and during the last week in March and the first in April the Aphid was checked by natural enemies and other factors in north-central Texas. Alates appeared at about this time and spread the infestation throughout most of the small-grain area of Oklahoma and into southern Kansas. Rain was general in north-central Texas in the first week of April, and it destroyed many of the Aphids and revived the few surviving food-plants. Damage was first observed in central Texas as early as November 1941; it occurred over a rather wide area in December, and migration of the Aphids continued throughout the winter, though the greatest spread occurred with the appearance of the alates in March and April. Crops on very fertile soil were reported to be less seriously damaged than those on poor soil, and damage was low on well-prepared seed-beds on which the seed was sown early and thickly.

The following is based on the authors' summary. The outbreak afforded opportunities of observing varietal resistance of wheat, oats and barley on an extensive scale in experimental plantings. Under heavy infestations, the most resistant strains of wheat were selections from the cross Marquillo x Oro, which are also resistant to the Hessian fly [*Mayetiola destructor*, Say]. Four other varieties, hybrids of one of them, and several Chinese and Russian strains showed some resistance, but were not able to withstand heavy infestation. A

considerable number of varieties of barley, mostly from China and Korea, were very resistant and produced a crop when surrounding strains were destroyed. Several strains originating from hybrids of oriental barleys were also highly resistant. Bulk hybrids showed resistance among the segregates when only one parent was resistant, suggesting that the resistance of these strains can be transferred to adapted varieties by hybridisation. The oats observed included most of the commercial red oat varieties and hybrid strains, but none showed outstanding resistance. Some differences in susceptibility were observed where infestation was less severe, but the varieties that were resistant were destroyed by heavier infestations.

STARR (D. F.). **The Action of a repellent Spray against the Mexican Fruitfly.**—*J. agric. Res.* **71** no. 9 pp. 415–422, 1 fig., 1 ref. Washington, D.C., 1945.

The following is based on the author's introduction and summary. During tests of repellent sprays against *Anastrepha ludens*, Lw., in an orange grove in Mexico in 1940, it was noted that the traps in sprayed trees sometimes yielded more fruit-flies than traps in comparable unsprayed trees, although counts of the infested oranges indicated that the sprays may have provided some protection. This apparent contradiction led to the hypothesis that, although a reduction in numbers of flies caused by a repellent is at first accompanied by a reduced catch, there is later an increased catch, possibly owing to the unusual activity of the flies in flitting from one repellent surface to another as the odour of the repellent becomes less pronounced. Thus a negative phase in the trap catches is followed by a positive phase, each of which may misrepresent the true fruit-fly population. Studies to test this hypothesis were accordingly made in 1941. Traps containing a fermented sugar solution were set out in two mango trees, one of which was sprayed about once a week from 27th March until 30th June. The spray contained a mixture of 27 ml. each of amyl acetate, cyclohexylamine, dicyclohexylamine and 99 per cent. *l*-nicotine, all of which have been shown to be repellent in previous work, with 135 ml. mineral oil as a fixative and 13·5 ml. oleic acid to form a soap emulsifier with the organic bases. The mixture formed an emulsion when poured into 9 litres tap water, and the whole amount was sprayed on the tree. The flies caught in the traps were counted before spraying and at various intervals (usually 3–5, 9–11 and 27–29 hours) after spraying, and the ratios of the counts in the two trees were analysed statistically. The repellent action was found to pass through two phases in its effect on the trap catch, a negative phase following the application of the repellent during which the catch in the sprayed tree was lower than in the unsprayed tree, and a positive phase in which the catch in the sprayed tree was above normal. Uniformity trials when the catches had returned to equilibrium after an application indicated that the differences were due to the action of the repellent and not to natural variation. A comparison of infestation in fruits from the sprayed and the unsprayed tree showed that the spray probably provided some protection for them.

HARRIES (F. H.), DECOURSEY (J. D.) & HOFMASTER (R. N.). **Some Factors affecting the insecticidal Action of Pyrethrum Extracts on the Beet Leafhopper.**—*J. agric. Res.* **71** no. 12 pp. 553–565, 1 fig., 7 refs. Washington, D.C., 1945.

The following is based on the authors' summary. The effects of temperature and humidity on the insecticidal action of pyrethrum extracts against *Eutettix tenellus*, Baker, were studied in laboratory tests under controlled conditions. The insecticides were applied by placing the leafhoppers in screen-covered cylindrical cages enclosed in a tubular air duct through which uniform changes of

spray or dust were passed by means of an electric blower. In most of the tests, they were immediately transferred to clean cages to eliminate the effect of the spray residue. The effect of temperature was studied by spraying the leafhoppers with pyrethrum extract in oil at different temperatures (50–100°F.) and then keeping them for 24 hours at these same temperatures, by spraying them at a common temperature (80°F.) and subsequently keeping them at different temperatures (60–100°F), and by spraying them at different temperatures (60–100°F.) and subsequently keeping them at 80°F. These tests showed that mortality could be increased by raising the temperature at the time of application and, to a still greater extent, by lowering it after application. It may therefore be inferred that the best control would be obtained from treatments made in the late afternoon, which would be followed by lower temperatures at night. Mortality was higher when the humidity during the observation period was low than when it was high, but the effect of humidity was much less pronounced than that of temperature. In a series of tests on the effect of the oil base of the pyrethrum-oil spray on insecticidal action, the highest mortalities were obtained when kerosene was used alone ; a combination of kerosene with light oils was more effective than one with heavy oils. A spray of pyrethrum extract in water and pyrethrum extract in a dust gave highest mortalities when the temperature was reduced after application and were not significantly influenced by humidity.

Annual Report of the Forest Insect Survey. . . 1944.—70 pp., 16 maps. Ottawa, Dep. Agric. Canada, 1945.

These reports on the status of the pests of forest and shade trees in Canada in 1944, which include notes on the natural enemies of some of them, are arranged on the same lines as those for 1943 [*R.A.E.*, A **33** 354]. W. A. Reeks, C. C. Smith & R. S. Forbes deal with the Maritime Provinces of Newfoundland (pp. 5–15, 5 maps), R. Lambert with Quebec (pp. 16–26, 1 map), C. E. Atwood with Ontario (pp. 27–39, 2 maps), H. A. Richmond & W. C. McGuffin with central Canada (pp. 40–51, 2 maps), L. O. T. Peterson with the agricultural area of the Prairie Provinces (pp. 52–61, 4 maps), and H. B. Leech with British Columbia and the Rocky Mountain National Parks (pp. 62–70, 2 maps).

Prebble (M. L.) & Graham (K.). **The current Outbreak of defoliating Insects in Coast Hemlock Forests of British Columbia. Part I. Description of Outbreak and Damage.**—*B. C. Lumberm.* Feb. 1945 repr. [6] pp., 11 figs., 1 ref. Vancouver, 1945.

Prebble (M. L.) & Graham (K.). **Part II. Factors of natural Control.**—*T.c.* Mar. 1945 repr. [5] pp., 6 figs.

Graham (K.). **Part III. Considerations of chemical Control.**—*T.c.* Apr. 1945 repr. [7] pp., 2 figs., 49 refs.

In the first of these papers, it is reported that defoliation and reddening of western hemlock [*Tsuga heterophylla*] and balsam [*Abies*] in the coastal districts of British Columbia have been increasing during the last few years. They were first conspicuous in 1940 and 1941 in rather small scattered areas in the southern part of the region, were noticeable throughout the hemlock stands of south-west Vancouver Island and in certain parts of the Queen Charlotte Islands by 1943 and were very pronounced in the north-west of Vancouver Island and widespread throughout Queen Charlotte Islands in 1944. *Acleris* (*Peronea*) *variana*, Fern., has been the principal insect involved, but a marked increase in the numbers of *Neodiprion tsugae*, Midd., *Ellopia fiscellaria lugubrosa*, Hulst, and *Orgyia* (*Notolophus*) *antiqua badia*, Hy. Edw., was noticed in 1944. The trend of the infestation and its extent in 1944 are discussed and illustrated on

maps, and short notes are given on the four insects, which are the most important defoliators of western hemlock.

The adults of *A. variana* are in flight from August to early October, and oviposit on the lower surface of the needles, principally near the tips of the branches in the upper crown. The larvae hatch in May or early June and feed first at the base of the immature needles in the opening buds, sometimes killing a succession of these, and later on the young shoots, on which they web together adjacent needles to form feeding shelters. They mature between mid-July and late August and pupate within the last feeding shelter. The pupal stage lasts 2–3 weeks. Western hemlock is the preferred food-plant, but mountain hemlock [*T. mertensiana*], balsam (both amabilis fir [*Abies amabilis*] and alpine fir [*A. lasiocarpa*]), Douglas fir [*Pseudotsuga taxifolia*] and spruce are also attacked. The adults of *Ellopia* are present in August and September and deposit eggs on foliage or tree trunks or in moss, lichens or débris. The larvae hatch in May and feed on the new foliage. They pupate on the foliage, the tree trunks or the ground, and the pupal stage lasts about a fortnight. Hemlock is the preferred food-plant, and in western North America severe injury has generally been confined to forests containing a large proportion of this tree, but practically any foliage may be attacked in heavily infested stands, including the old and new leaves of hemlock, balsam, Douglas fir, spruce and western red cedar [*Thuja plicata*] and the leaves of many deciduous trees and shrubs. Adults of *Neodiprion* are present from late August until October and deposit eggs within the needles of western hemlock, which is the preferred food-plant, although mountain hemlock and amabilis fir are also attacked. The larvae hatch in late May and feed first on old foliage and later on new leaves if necessary; they pupate in cocoons on the branches or in débris on the ground. Adults of *Orgyia* appear in late August and September, and the wingless females deposit masses of eggs on the bark or lichens or on the cocoons from which they emerged. The larvae hatch in spring and pupate in shelters made of hairs and needle fragments, usually on the twigs. This Lymantriid feeds on a wide variety of deciduous trees and shrubs as well as spruce, Douglas fir and western hemlock; it consumed both new and old foliage of the last in 1944. Discoloration of infested trees during late summer is due to the temporary adherence of damaged and severed needles, which turn reddish-brown on drying.

The dates and localities of cycles of abundance of these insects are recorded, and it is concluded that they occur approximately every 10–15 years, and that although the precise factors that cause them are not known, climatic conditions, comparative unimportance of control by disease and parasites, and the existence or creation of favourable food supplies through forest composition are undoubtedly important. In the present outbreak, the appearance of heavy infestations in restricted areas many miles from other known areas of heavy infestation, and the simultaneous appearance of heavy infestations on islands separated by wide expanses of water do not support the theory of a progressive spread of infestation from focal points, but suggest that the infestation in a district develops from the residual insect population already present there, and that differences in the time of appearance of different infestations are merely due to local variations in the occurrence of natural factors. It is therefore unlikely that direct control in the first known areas of infestation would prevent general outbreaks.

The damage in heavily infested forests in which defoliation was caused almost entirely by *A. variana* and in those in which the other species were also active is discussed, but it is considered impossible to draw final conclusions until the end of the outbreak.

The second part of the series includes a general discussion of factors that cause changes in the population of insects, and notes on the natural control of *A. variana* with details of how it operates in certain of the infested districts. The

prevailing winter temperatures are unimportant, as the hibernating eggs can withstand the much more severe temperatures of central and eastern Canada. Cold, wet weather during late May and early June, when the eggs are hatching, is unfavourable to the young larvae, but this has not been of much importance in the current outbreak. Shortage of food causes large numbers of larvae to drop from the defoliated trees, and although many reach trees with sufficient foliage to permit their full growth, the ultimate effect of such migration on the population as a whole is unfavourable. *Podisus serieventris*, Uhl., ants, spiders and birds are the most important predators, but are seldom numerous enough to control a heavy infestation. About 40 species of parasites attack *A. variana* in the coastal district; notes are given on the bionomics of the typical egg parasite, *Trichogramma minutum*, Ril., a larval parasite, *Ascogaster* sp., and pupal parasites, *Itoplectis obesus*, Cushm., and *Phaeogenes arcticus*, Cushm. One of the most effective factors in natural control is a wilt disease of the larvae and pupae. The moths are apparently not killed by it, but there is evidence that those that have survived it in the immature stages can transmit it to the eggs. It may occur in a benign form or be so active as to eliminate an infestation in a short time, and it was the critical controlling factor in the three infestations most intensively studied.

Orgyia, *Ellopia* and *Neodiprion* are also attacked by a number of parasites, and there is evidence that *Ellopia* and *Neodiprion* are occasionally affected by diseases, but the current infestations of these insects are of too recent origin to show the value of different factors in natural control.

The third paper is based mainly on the literature. The author points out that the chief value of insecticidal control of a native pest lies in the protection that it affords when natural agencies of control are temporarily unable to prevent serious losses. It should not be applied in any given area until investigation has shown the insufficiency of natural factors there. Its justification depends on the value of the crop, the nature of the probable damage by the insects, and the cost of treatment, and the last depends mainly on the type of equipment that can be used to distribute the insecticide. The effectiveness of different forms of equipment, including power sprayers, power dusters, dust-bomb mortars, smoke candles, and aeroplanes or autogiros fitted with spraying or dusting apparatus, and the form in which the chemicals are used, including sprays, dusts and insecticidal smokes or aerosols, are described, and details are given of the chemical compounds used and the quantities required, and of the factors influencing the distribution, retention and effectiveness of the insecticides.

BENNETT (C. W.), CARSNER (E.), COONS (G. H.) & BRANDES (E. W.). **The Argentine Curly Top of Sugar Beet.**—*J. agric. Res.* **72** no. 1 pp. 19–48, 8 figs., 21 refs. Washington, D.C., 1946.

The following is based on the authors' summary. Studies of the curly-top disease of sugar-beet that occurs in Argentina, where the vector is a Jassid [*cf. R.A.E.*, A **15** 458; **16** 575] now known to be *Agalliana ensigera*, Oman [*cf.* **29** 608], were made at Arlington, Virginia in 1927 and 1937–39, using infected plants from Argentina. Further studies were made at Tucumán, Argentina, in the period from September 1940 to March 1941.

The symptoms on plants from Argentina grown in the quarantine greenhouse at Arlington were similar to those on plants affected with the North American curly-top disease, but *Eutettix tenellus*, Baker, the vector of the latter, failed to transmit the Argentine virus. In the Province of Tucumán, curly-top disease was found on sugar-beet, red garden beet, spinach beet, mangel and *Physalis* sp., and probably on cultivated petunia (x *Petunia hybrida*). It was transmitted experimentally by means of *A. ensigera* to *Stellaria media*, *Zinnia elegans* and several varieties of sugar-beet, but not to any member of the family Solanaceae,

including tomato, tobacco, *Datura stramonium*, *Capsicum* and petunia. Symptoms of the disease on beets, mangel, *Stellaria* and *Zinnia*, consisting of veinlet clearing, vein swelling, vein protuberances, leaf rolling and phloem necrosis, were similar to those produced by the North American virus on these plants. In general, symptoms of the Argentine virus were more severe on seedling sugar-beet than those of the North American one, especially in the case of varieties resistant to the latter. However, seedlings affected with the Argentine virus recovered to a marked degree from the initially severe effects of the disease, and then showed only mild symptoms, if any, depending on the resistance of the variety, whereas sugar-beet plants affected with North American curly-top have not been observed to recover to any appreciable extent. Three varieties known to be resistant to the North American virus were resistant to the Argentine virus, and one variety that is very susceptible to the former was relatively susceptible to the latter.

In the grounds of the Agricultural Experiment Station of Tucumán, *A. ensigera* was abundant throughout the season of 1940–41 on mangels and sugar-beets and was found in smaller numbers on *Amarantus* spp., *Portulaca* sp., *Datura stramonium*, *Zinnia elegans* and *Chenopodium album*. It was apparently very rare, however, on plants outside the cultivated area. It multiplied readily on sugar-beet and mangel and was able to breed on *Amarantus* spp., *D. stramonium*, *D. meteloides* and *Z. elegans*, and to a limited extent on *C. album*; it failed to breed on tomato, Turkish tobacco or *Nicotiana glutinosa*. It feeds on the phloem of sugar-beet and leaves a partial sheath of salivary secretion along the line of puncture. It can pick up virus from liquids containing phloem exudate of diseased beets, but unlike *E. tenellus*, it was not observed to leave salivary deposits in the liquid media on which it fed. The minimum incubation period found for the virus in the leafhopper was 24–72 hours, and the virus in viruliferous leafhoppers was not exhausted by a 36-day feeding period on an immune plant. Limited tests indicate that it does not pass through the egg stage of the insect.

The virus appears to occur in relatively high concentrations in the phloem of infected sugar-beets and mangels. The thermal inactivation point seems to be between 75 and 80°C. [167 and 176°F.]. The virus was not inactivated by a short exposure to 50 per cent. alcohol. By means of phloem exudate from infected sugar-beets, it was transmitted to 4 of 20 rapidly growing sugar-beets by needle inoculation, but no infection resulted from rubbing inoculum over the surface of leaves. The virus moved from the point of introduction by leafhopper inoculation at the distal end of a beet leaf downward through the leaf, a distance of 15 cm., in two hours. These properties of the Argentine virus are similar to those of the North American one so far as they are known. The similarity between the two viruses in the general type of symptoms on known host plants, in known host range except for Solanaceae, in known properties and in the resistance manifested by tested sugar-beet varieties appears so significant that, despite the differences in vectors and in the degree of recovery of affected plants as the disease progresses, it seems best to classify the Argentine virus as a variety (*Ruga verrucosans* var. *distans*, n.) of the curly-top virus complex of North America. The name *R. verrucosans* for the latter was proposed by two of the authors (Carsner & Bennett) in 1943 in substitution for *Chlorogenus eutetticola* of Holmes.

HUNT (G. M.) & SNYDER (T. E.). **An international Termite Exposure Test—Sixteenth Progress Report.**—[*Proc.*] *Amer. Wood Pres. Ass.* [**41**] preprint 16 pp. [Baltimore, Md.] 1945.

In this progress report on the effectiveness of various chemicals in preserving specimens of wood from attack by decay and termites [*cf. R.A.E.*, A **34** 32, etc.], data are tabulated on the condition in 1944 of the specimens installed in 1928, 1929, 1931, 1933, 1938, 1940 and 1941.

[Reĭngard (L. V.) & Zabud'ko-Reĭngard (T. N.).] **Рейнгард (Л. В.) и Забудько-Рейнгард (Т. Н.). The common Mayweed** (*Matricaria inodora*) **as a good but little studied Insecticide.** [*In Russian.*]—*Med. Parasitol.* **14** no. 3 p. 92. Moscow, 1945.

In tests with several plants that are common in the North Caucasus, the only one that showed promise as a source of insecticide was *Matricaria inodora*, the powdered dried flowers of which proved as effective in laboratory tests against *Musca autumnalis*, Deg. (*corvina*, F.) as a commercial pyrethrum powder. The powdered dried leaves used were ineffective.

Woo (Ta-chang) & Hsiang (Cheng-heng). **Studies on the Cotton Measuring-worm** *Anomis flava* **(Lepidoptera).** [*In Chinese.*]—*Tech. Bull. Szechwan prov. agric. Improvemt Inst.* no. 1, 23 pp., 1 fldg. pl., 2 figs., 11 refs. Chengtu, 1939. (With a Summary in English.)

The following is taken from the authors' summary. *Cosmophila* (*Anomis*) *flava*, F., is often abundant on cotton in Szechwan, where the larvae cause considerable damage to the leaves and sometimes attack the squares and young bolls. Studies of its bionomics in 1938–40 showed that there are six generations a year. The winter is passed in the pupal stage within the folded leaves, and the first moths emerge in early April. The larvae of the successive generations appear in mid-May, late June, mid-July, early August, early October and mid-November. The eggs are generally deposited singly upon the lower surface of the leaves. There are six larval instars and the average duration of the larval stage varies from 12 days in the third generation to 34 days in the sixth. The larvae were parasitised by *Apanteles ruficrus*, Hal. and *Zacharops narangae*, Cushm., and the pupae by *Xanthopimpla punctata*, F., and *Brachymeria obscurata*, Wlk. Effective control measures comprise the use of a spray containing 1–2 lb. calcium arsenate in 100 gals. water against the larvae and of light-traps against the adults.

Petherbridge (M. A.) & Weston (W. A. R. D.). **Frit-fly.**—*Agriculture* **52** no. 10 pp. 463–464, 1 fig. London, 1946.

The frit-fly [*Oscinella frit*, L.], the life-cycle of which is briefly outlined [*cf. R.A.E.*, A **33** 199], is an important pest of late-sown spring oats in England and may also severely damage winter wheat and barley following grass leys. Winter cereals should not be sown after a grass ley, especially ryegrass [*Lolium perenne*], unless the field has been ploughed before harvest time ; if it is ploughed later, the cereals may be severely affected by the larvae that migrate from the buried grass. Winter oats suffer little from larvae of the spring generation, but spring oats may be severely damaged. They are very resistant, however, after they have developed more than four leaves, and early sowing is the best way of enabling them to reach this stage before the adults of the overwintered generation emerge. Its value is illustrated by an experiment in which the yields of grain and (in brackets) straw in cwt. per acre were 16 (42·7), 14·9 (31), 15·2 (29·3) and 10·7(25·1) from plots sown with oats at the rate of 3 bushels per acre on 1st and 20th February and 1st and 15th March, and 9·9 (25·3), 6·2 (18·1) and 2 (8·8) from others sown at a rate of 4 bushels per acre on 23rd and 31st March and 14th April. Early growth is also assisted by a light dressing of a quick-acting nitrogenous fertiliser, but it is important that the soil should also contain adequate supplies of phosphates and potash. Although an increased seeding rate is of some value where early sowing is impossible, it is better under such circumstances to replace oats by barley. One variety of oats has shown some resistance to attack.

WALLACE (C. R.). **The Black Beetle (*Heteronychus sanctae-helenae*) as it affects Coastal Vegetable Growers and Horticulturists.**—*Agric. Gaz. N.S.W.* **56** pt. 8 pp. 339–342, 348, 1 fig., 5 refs. Sydney, 1945.

Adults of the Dynastid, *Heteronychus sanctae-helenae*, Blanch., have been a major pest of maize and a wide variety of vegetable crops in the coastal areas of New South Wales since 1930 [*cf. R.A.E.*, A **22** 343; **28** 46]. They are injurious from September to mid-May, feed on the stems or tap-roots of plants just below the surface of the soil, and also damage the tubers of sweet potatoes, cuttings of sugar-cane and grape vines, the suckers of banana, and fruits of strawberry and tomato resting on the ground. Lists are given of the plants that are favoured or avoided by them. Since undisturbed grassland is the chief breeding-ground, land under grass weeds should be examined for infestation before it is used for a crop. Infested land should either be used for crops that are not attacked, which include leguminous plants and silver beet, or susceptible plants, such as swedes, cucurbits and particularly potatoes, rhubarb and maize, should be grown in it only between mid-May and the end of August. The planting out of crucifers and tomatos, which are susceptible during the seedling stage and immune when mature, should be timed so that the seedling stage is passed during this period. Headlands should be cleared and sown with lucerne or clover.

During outbreaks, the beetles can be collected by hand from the surface soil, particularly in crops of cabbage, cauliflower and tomatos, or immediately under strawberry fruits or under baits consisting of pieces of sugar-cane stalk 10–11 ins. long and split in half longitudinally, with the cut surface placed in contact with the soil. These baits were found to be very effective in the spring of 1944, and were still attracting beetles after five weeks in unusually hot and dry weather. Apart from their value for enabling the beetles to be collected, the attraction exercised by them appeared to reduce the damage to crops nearby. Baits of maize stalk and ripe sweet-potato tubers have also been found effective. A DDT dust mixed with the soil has shown promise in preliminary work [*cf.* **34** 208].

LLOYD (N. C.). **DDT as an Insecticide. Results of preliminary Trials.**—*Agric. Gaz. N.S.W.* **56** pt. 8 pp. 347–348. Sydney, 1945.

This paper and the three that follow contain the results of preliminary experiments carried out in 1944–45 in New South Wales to determine the value of DDT for the control of various pests of crops. Aqueous emulsions of solutions of DDT, usually in solvent naphtha, were used for the sprays, and the dusts consisted of DDT in pyrophyllite. In an experiment in which various insecticides were applied on 10th and 17th November to potatoes infested by larvae of *Gnorimoschema operculella*, Zell., differences in infestation figures, based on the amount of foliage injury found on 6th, 10th, 19th and 22nd November, were highly significant. A 2 per cent. DDT dust was outstanding and virtually eliminated the larvae from the foliage; a 1 per cent. DDT dust and mixtures of cryolite and kaolin (1 : 1), and of derris and kaolin (1 : 4) were also very effective. In a second test, the two DDT dusts, the dust of derris and kaolin and a spray containing 0·1 per cent. DDT were applied on 28th February, 13th–14th March and 28th March. The DDT treatments proved very effective, and there was no significant difference between them. The derris dust gave quite good control, but a certain amount of infestation persisted in the lower leaves.

The 2 per cent. dust was also tested against *Nysius vinitor*, Bergr. Infested potatoes were dusted on 17th November, and the numbers of bugs on treated and untreated plants four days later averaged 1·45 and 9·05, respectively. Adults dusted in jars all died in eight hours, while mortality in the controls was very low. When strips of infested weeds and *Nicandra* plants were dusted, they

were almost free from the bugs 24 hours later, while undusted ones were still heavily infested; after a further 24 hours the *Nicandra* plants were still free from them.

HELY (P. C.). **DDT as an Insecticide. Result of preliminary Trials.**—*Agric. Gaz. N.S.W.* **56** pt. 9 pp. 397–400. Sydney, 1945.

Further tests of DDT in New South Wales [*cf.* preceding abstract] included an experiment against *Plutella maculipennis*, Curt., *Pieris rapae*, L., and *Brevicoryne brassicae*, L., on cabbage. The treatments comprised sprays of 0·05 and 0·1 per cent. DDT, and dusts of 1 and 2 per cent. DDT and 50 per cent. lead arsenate in pyrophyllite. Seven weekly applications were made, beginning on 3rd January, when *Plutella* and *Pieris* were abundant and some Aphids were present. The results were estimated on 28th February, when harvest began, and showed that all the DDT treatments gave excellent control of the Lepidoptera, with no significant difference between them, and were superior to lead arsenate. They also maintained almost complete control throughout the cutting period, whereas lead arsenate did not, and plants in untreated plots were unmarketable. The results as regards *B. brassicae* were inconclusive.

Mixtures of 1 oz. tartar emetic or 0·05 per cent. DDT in sugar solution, applied to beans coming into flower as bait-sprays against *Taeniothrips nigricornis*, Schmutz, gave no reduction in injury at harvest.

When examples of *Nezara viridula*, L., in wire-gauze envelopes were sprayed or dusted with DDT and removed to cages after 15 minutes, sprays with a minimum concentration of 0·0625 per cent. DDT were toxic, but even the highest concentration tested (0·6667 per cent.), was comparatively slow in action, mortality not being complete until at least 70 hours after treatment. Dusts of 2 and 3 per cent. DDT did not give complete mortality. Insectary tests in which fifth-instar nymphs of *Rhoecocoris sulciventris*, Stål, on small plants were sprayed with mixtures containing 0·5, 0·25, 0·125 and 0·0625 per cent. DDT and transferred ten minutes later to lemon seedlings showed that DDT at the three higher concentrations had a definite but slow toxic action, the periods required for complete mortality being 96 hours for 5 per cent. DDT and 192 hours for 0·25 and 0·125 per cent. DDT; 60 per cent. of the controls were still alive after 14 days. In field tests, *Citrus* trees heavily infested with nymphs and adults were sprayed with a suspension of 10 per cent. DDT in pyrophyllite (0·15 per cent. actual DDT). High mortality resulted, and the slow but progressive action indicated that a higher concentration was desirable.

In a field experiment begun on 14th May, late sown carrots heavily infested with larvae of *Listroderes obliquus*, Gylh., were dusted with 0·5, 1 and 2 per cent. DDT or a mixture of equal parts of lead arsenate, hydrated lime and tobacco dust, or sprayed with 0·1 per cent. DDT. The three applications that had been given up to the time of the report substantially reduced the numbers of larvae as compared with untreated plots, and the lead arsenate appeared to be as effective as any of the DDT treatments. Infestation by the Aphid, *Cavariella aegopodii*, Scop., which developed throughout the crop, was kept at a reasonably low level by the DDT dusts, and the spray appeared to give outstanding control. A spray of 0·05 per cent. DDT with 4 fl. oz. white oil per 2 gals. gave very satisfactory results against adults of *Pantomorus godmani*, Crotch, on *Citrus* trees two years old, and was still effective against weevils placed on the foliage eight days after application. Sodium fluosilicate and cryolite (1 oz. to 2 gals.) were satisfactory but not nearly so rapid in action as DDT, and a spray of tartar emetic was not effective.

A dust of 2 per cent. DDT at ½ lb. per bushel completely protected stored beans against *Bruchus obtectus*, Say, and a 1 per cent. dust at ¼ or ⅛ lb. was highly effective.

In an experiment against *Agromyza phaseoli*, Coq., a spray containing 0·1 per cent. DDT, alone or with the addition of white oil (6 fl. oz. to 4 gals.) was applied to beans four times between 5th and 16th April. The flies were abundant early in this period, but became less plentiful during the following weeks. The plants showed almost complete freedom from injury by the larvae on 21st June, whereas moderate injury was found on 88·7 per cent. of those given the standard spray of nicotine sulphate and white oil [*cf. R.A.E.*, A **26** 335; **28** 564].

On 19th January, orange trees heavily infested with *Aceria* (*Eriophyes*) *sheldoni*, Ewing, were sprayed with 0·1 per cent. DDT, white-oil emulsion (1 : 40) or lime-sulphur (1 : 40) with a wetting agent. On 9th May, practically no buds injured by mites were found on trees sprayed with oil or lime-sulphur, whereas 17 per cent. of buds on unsprayed trees and 9·8 per cent. of those on trees sprayed with DDT showed mite injury. Dusts containing 1 or 2 per cent. DDT proved ineffective against *Tetranychus telarius*, L. (*urticae*, Koch) on potted bean plants. Orange trees were sprayed in February with Bordeaux mixture (1 : 1 : 40) containing white oil (1 : 40 and 1 : 160), colloidal sulphur (1 lb. to 40 gals.) or white oil (1 : 40) and 0·0875 per cent. DDT, and the fruits were examined in June for infestation by *Phyllocoptruta oleivorus*, Ashm., and *Lepidosaphes beckii*, Newm. Some injury by the mite was found on almost every tree sprayed with the mixture of white oil and DDT, which appeared to have stimulated its development, possibly by destroying its natural enemies, but the mixture was slightly more effective against the Coccid than white oil alone and considerably more so than colloidal sulphur, which was the only other treatment that permitted mite injury.

FRIEND (A. H.) & PASFIELD (G.). **DDT as an Insecticide. Results of preliminary Trials.**—*Agric. Gaz. N.S.W.* **56** pt. 10 pp. 455–456, 467. Sydney, 1945.

Further tests with DDT in New South Wales [*cf.* two preceding abstracts] are described in two sections, by Friend and Pasfield respectively. In the first, the ineffectiveness of the 1 per cent. dust against *Tetranychus telarius*, L. (*urticae*, Koch) on beans is confirmed. In further tests against *Plutella maculipennis*, Curt., *Pieris rapae*, L., and *Brevicoryne brassicae*, L., the 1 per cent. dust was applied four times at weekly intervals, to cabbages, beginning when they were half-grown and heavily infested. Larvae of both Lepidoptera were completely eliminated a week after the second application, and the Aphid after the third. The plants remained uninfested for three weeks after the fourth treatment and produced reasonably good hearts, while untreated plants did not. Complete control of the Aphid on cauliflower was given by routine fortnightly or monthly applications of sprays of 0·05 per cent. DDT, and the effectiveness of DDT was not reduced by combination with Bordeaux mixture (1 : 1 : 40). Weekly applications of the 1 per cent. DDT dust to onions heavily infested by *Thrips tabaci*, Lind., proved as effective as a fine mist spray of tartar emetic and sugar. Four weekly applications of either treatment reduced the infestation by about 80 per cent., as compared with untreated plots.

When the 2 per cent. DDT dust and a 0·2 per cent. DDT spray were applied against *Dicyphus* sp., which was seriously preventing the expansion of young rhubarb leaves, leaf expansion in the treated plots was normal after a fortnight, while it was still poor in plots left untreated or dusted with 6 per cent. nicotine sulphate. In further trials against *Nysius vinitor*, Bergr., three applications at weekly intervals of the 1 per cent. dust to heavily infested silver beet proved ineffective, apart from temporary repellence after dusting, but the 2 per cent. dust gave excellent control in another small test and in the laboratory. Dusts of 1 or 2 per cent. DDT and a spray of 0·2 per cent. applied ten times at weekly intervals gave complete control of *Empoasca* sp. on heavily

infested tomatos, and showed satisfactory residual toxicity. They somewhat retarded, but did not control, a severe infestation by *Phyllocoptes lycopersici*, Massee, that developed later in the experiment.

In laboratory experiments, the 1 per cent. dust gave excellent control of *Rhopalosiphum prunifoliae*, Fitch, on heavily infested wheat, but showed little residual toxicity, and gave complete mortality in six days of *Myzus persicae*, Sulz., on peach foliage. This dust and a spray of 0·1 per cent. DDT gave some control of *Macrosiphum solanifolii*, Ashm., on gladiolus in the field and were very effective against *Taeniothrips simplex*, Morison. The population of adult thrips was reduced by 95 per cent., as compared with untreated plants, a week after dusting. In a comparative field experiment, the DDT dust was as effective as a spray of tartar emetic and sugar ; seven weekly applications of each were made, since previous work had shown that the dust on *Gladiolus* loses its toxicity to the thrips after a week. Laboratory tests showed that DDT rapidly inactivates the thrips by contact, nymphs succumbing more quickly than adults.

Dusts containing 10 per cent. DDT mixed with stored beans and wheat at rates of 1 lb. and 5 oz. per bushel, respectively, gave complete and lasting control of *Bruchus obtectus*, Say, in the beans and of *Calandra oryzae*, L., and *C. granaria*, L., in the wheat.

In the second section an account is given of laboratory tests on the relative value of DDT, tartar emetic and nicotine sulphate in bait-sprays against *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg. The concentrations used were 0·1, 0·2 and 0·3 per cent. for DDT, 2 oz. to 4 gals. for tartar emetic, and 1 fl. oz. to 3 gals. for nicotine sulphate. They were applied in sugar solution (used mainly at a strength of 2½ lb. to 4 gals.), to the glass tops of small cages or to the foliage of small *Citrus* trees, which were then caged. All the DDT sprays were as effective as tartar emetic, which was somewhat improved by reduction of the sugar content, and the 0·3 per cent. spray may even have been superior. Nicotine sulphate was not promising. When 20 adults were placed in a small cage, the glass top of which had been rubbed six hours previously with a 4 per cent. solution of DDT in deodorised kerosene, the percentage mortality 24 hours later was 95 ; 92·7 per cent. mortality was obtained in the same time in a similar cage, a small circle on the glass top of which was treated with 0·3 per cent. DDT in sugar solution.

WASON (E. J.). **DDT as an Insecticide. Results of preliminary Trials.**—*Agric. Gaz. N.S.W.* **56** pt. 11 p. 498. Sydney, 1945.

In this concluding part of an account of the results obtained in preliminary tests with DDT in New South Wales [*cf.* three preceding abstracts], it is stated that cabbage plants were found to be free from *Plutella maculipennis*, Curt., *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz., after being dusted nine times at intervals of 8–10 days with 1 per cent. DDT for all applications or with a mixture containing 50 per cent. lead arsenate and 2½ per cent. nicotine up to the hearting stage and then with derris. Of untreated plants 76 per cent. were infested, some by all three pests. DDT appeared to have a stimulating effect on the growth of the plants, as indicated by the yield of cabbages trimmed for market.

Four of eight young peach trees infested by *Anuraphis persicae-niger*, Smith, were sprayed on 11th August (while semi-dormant) with kerosene emulsion (1:40) containing 0·1 per cent. DDT. No living Aphids were found 24 hours later and the treated portions of the trees were still uninfested after 42 days, although a few Aphids were observed on blossoms and new growths after 35 days. Infestation increased on the four unsprayed trees during this period and seriously retarded new growth. A 0·1 per cent. suspension of DDT in water, with soap powder as a wetting agent, was subsequently applied to these trees ; the suspension was unsatisfactory in application, but a good kill of Aphids over a

period of nine days was obtained. A 0·2 per cent. suspension of DDT in water was then applied; it gave better control in five days, and the trees were uninfested 40 days after its application. It appeared that the effectiveness of DDT was cumulative and that the film deposited on the tree prevented the Aphids from settling and reproducing on the sprayed areas, though both Aphids and ants were able to move about on them without being noticeably affected.

PASFIELD (G.). **Control of Cabbage Pests. Outstanding Results with DDT and 666 Dusts.**—*Agric. Gaz. N.S.W.* **56** pt. 11 pp. 489–492, 6 figs. Sydney, 1945.

In an experiment carried out in New South Wales in 1945, outstanding results were obtained with dusts containing DDT and 666 (benzene hexachloride) [*cf. R.A.E.*, A **33** 256, 331] in the control of *Plutella maculipennis*, Curt., and *Pieris rapae*, L., on cabbage. The cabbages used had been grown from seed and treated at the end of March, when they were in the two-leaf stage, with a dust of 40 per cent. lead arsenate and a week later with one of 50 per cent., which controlled a heavy infestation by larvae of *Plutella*. The experimental treatments were applied on 12th and 23rd April, 3rd, 14th and 25th May, 5th, 19th and 29th June, and 10th July, and consisted of dusts containing 0·5, 1 or 2 per cent. DDT or 1 per cent. 666, all in pyrophyllite, and a proprietary dust containing 37 per cent. lead arsenate with nicotine. Within 11 days of the first application, untreated cabbages were heavily infested with larvae of *Plutella* and *Pieris*, and none of those that survived was marketable. After the second application, cabbages dusted with the lead arsenate mixture showed increasing infestation, which was unaffected by a considerable increase in the rate of application, and were finally classed as second grade. The cabbages dusted with 666 showed slight damage by the larvae during the first month and none subsequently, despite the deposition of eggs on them by *Plutella* and *Pieris*. Cabbages dusted with DDT sustained no damage, since all the larvae that hatched from eggs laid on them were killed. Other insects present during the experiment were *Myzus persicae*, Sulz., which persisted until the end of May and did not appear to harm the plants or to be affected by any of the treatments, *Brevicoryne brassicae*, L., which occurred in small numbers but did not become established, larvae of *Listroderes obliquus*, Gylh., to which both DDT and 666 appeared either toxic or repellent, and *Heteronychus sanctae-helenae*, Blanch. The efficiency of DDT and 666 was not affected by 12 inches of rain that fell during the experiment, and it was thought that the intervals between applications could be increased, even if heavy rain fell. Cabbages dusted with DDT and 666 were eaten by man and various domestic animals without apparent ill effect.

SMITH (J. H.). **A new Insecticide—D.D.T.**—*Qd agric. J.* **61** pt. 4 pp. 216–220. Brisbane, 1945.

The results of preliminary tests carried out in Queensland with dusts of DDT in kaolin, pyrophyllite or talc and with sprays of DDT emulsified in water indicated that dusts containing 1 per cent. DDT and sprays containing 0·1 per cent. should give effective control of the bean fly [*Agromyza phaseoli*, Coq.] if applied within three days of germination and then every four days for 8–20 days, depending on the time of year and intensity of attack; of the green vegetable bug [*Nezara viridula*, L.] if applied at weekly intervals after the first appearance of the pest in the crop; of the beet webworm [*Hymenia recurvalis*, F.]; of the cabbage moth [*Plutella maculipennis*, Curt.] if applied at intervals of a fortnight or when larvae are seen on the plants; of the brown

vegetable weevil [*Listroderes obliquus*, Gylh.] on lettuce or celery; of the corn ear worm [*Heliothis armigera*, Hb.] on crops such as sorghum, on which the larvae feed on the treated surface, and of Jassids. DDT, particularly as a spray, is also effective against the potato tuber moth [*Gnorimoschema operculella*, Zell.] in the field, but has given variable results against Aphids and thrips, and may cause an increase in mite populations by killing their natural enemies.

The possible advantages of DDT, the risk of its injuring plants and the problem of residues are discussed shortly, and it is emphasized that applications to plants of which the treated parts are used for food should cease at least three weeks before harvesting begins.

SLOAN (W. J. S.). **Insect Pests of Grain Sorghum.**—*Qd agric. J.* **61** pt. 4 pp. 221–232, 9 figs. Brisbane, 1945.

Notes are given on the bionomics and control of the more important insects that attack grain sorghum in Queensland. The information on *Contarinia sorghicola*, Coq., is similar to that already noticed [*R.A.E.*, A **30** 499]. *Heliothis armigera*, Hb., may attack the plants at all stages of growth, but is primarily a pest of the flower heads and developing grain. Eggs are laid sometimes on young plants, when the larvae feed mainly on the leaves of the growing tip, but more commonly on the sorghum heads as soon as they appear, in which case the larvae feed first on the flowers and later on the soft grain. The egg, larval and pupal stages last 3–6, 12–21 and 10–14 days during summer. Infestation can be reduced by suppressing weeds on which breeding occurs, and crops maturing in late April and May are seldom heavily infested. *Dichocrocis punctiferalis*, Gn., is most injurious to grain sorghum in the wetter areas near the coast, where it may cause almost complete failure of the crop. The plants become infested as the grain begins to mature, and attack may develop rapidly. The larvae feed on the grain and cover the heads with webbing and excreta, sometimes binding together heads that touch each other. They also sometimes bore into the pith of the stalks. The larval and pupal stages last 3 and 2–3 weeks in warm weather and the pupal stage 8 weeks or more in winter; the larvae feed little in cold weather. Control measures include harvesting the grain as soon as it is dry and threshing it immediately unless header harvesters are used, burning the residues of infested crops after harvest and ploughing the field in winter. Grain sorghum should not be planted near maize that will mature before it and provide a source of infestation. Damage is less severe in varieties with open heads and in sorghum that has been planted closely, so that the size of the individual heads is reduced without affecting the gross yield per acre. Another Pyralid, which belongs to the genus *Homoeosoma*, causes similar damage to the heads and may occur together with *Dichocrocis*, in which case the larvae of the former are the more abundant, but less injurious individually. The moths ovipost on the head shortly after it appears, and the larvae feed on the developing grain and pupate within the head. Attacks continue as long as the crop remains in the field, and can be reduced by the cultural measures recommended against *D. punctiferalis*.

Grain sorghum is attacked at any stage of growth by locusts and grasshoppers, including *Chortoicetes terminifera*, Wlk., *Austracris guttulosa*, Wlk., *Gastrimargus musicus*, F., and *Valanga irregularis*, Wlk., which can be controlled by broadcasting a bait of ½ lb. arsenic pentoxide, 1–1½ quarts molasses, 24 lb. bran and 2½ gals. water as soon as bands of young hoppers appear. *Aphis maidis*, Fitch, is a common pest of grain sorghum, concentrating round the growing tip and sometimes causing the terminal leaf to collapse, in which case the heads often fail to emerge cleanly from the surrounding leaves. Infestation of the heads is common even in crops growing under good conditions, but parasites and predators become active late in the season and usually destroy the Aphids

before the crop is harvested, although the grain may be discoloured by sooty moulds that develop on their excretions. Control by means of insecticides is not usually justified. Less important insects that are often seen in grain sorghum heads include larvae of *Pyroderces dendrophaga*, Meyr., and adults of *Carpophilus hemipterus*, L., both of which feed on injured grain, *Nezara viridula*, L., and *Nysius vinitor*, Bergr., which suck the sap from immature heads, and *Orius* (*Triphleps*) *australis*, China, which preys on other insects.

Both *Sitotroga cerealella*, Ol., and *Calandra* (*Sitophilus*) *oryzae*, L., attack grain sorghum in the field, but they are most important as pests of the stored seed. The eggs of *Sitotroga* are laid singly or in batches on the heads as the grain matures and those of *Calandra* in cavities excavated in the grain; the larvae of both feed and pupate in the grain, the life-cycle lasting about four weeks in summer. To protect the grain from attack, it should be harvested as soon as mature and kept as dry as possible. If necessary, it should be fumigated with carbon bisulphide for 36 hours at the rate of 5 lb. (3 pints) per 1,000 cu. ft. air space in a gas-tight chamber or at least twice this dosage under a tarpaulin or in an unsealed barn. Mixing the grain with 4 oz. ground magnesite per bushel so that it is thoroughly covered retards and sometimes prevents the development of *C. oryzae*; the treated grain can safely be fed to stock.

Papers noticed by Title only.

Lever (R. J. A. W.). **An annotated Check List of the Mealy Bugs and Scale Insects of Fiji** [food-plants of 51 species].—*Agric. J. Fiji* **16** no. 2 pp. 41–44, 9 refs. Suva, 1945.

Bowen (C. V.). **Report on Nicotine** [methods of analysis].—*J. Ass. off. agric. Chem.* **28** no. 3 pp. 578–585, 18 refs. Washington, D.C., 1945.

Fleck (E. E.). **Report on Methods of Analysis of DDT.**—*J. Ass. off. agric. Chem.* **28** no. 3 pp. 585–589, 1 fig., 12 refs. Washington, D.C., 1945.

Gätzi (K.) & Stammbach (W.). **Ueber die Nebenprodukte des technischen DDT.** [On the By-products of technical DDT.]—*Experientia* **1** no. 8 p. 276, 2 refs. Basle, 1945. [*Cf. R.A.E.*, A **34** 359.]

Markwood (L. N.), Mann (H. D.) & Carter (R. H.). **Quantitative Determination of Bases by Means of Calomel. Application to Lime in commercial Calcium Arsenate.**—*Industr. Engng Chem.* Anal. Edn., **17** pp. 570–571, 3 refs. Easton, Pa., 1945.